

QuickStart

User Manual



BL3408E2-D01-DC080

Plug-n-Play Servo System
with digital drive, brushless motor and cables
(Continuous 8.4 lb-in, 5100 rpm)

Thank you for purchasing this QuickStart package!

QuickStart makes it easy to set up Advanced Motion Controls drives to get your system running quickly. The drive and motor have been matched with each other, the cables are custom made for this system and an interface board simplifies integration with your controller.

Remember, if you need us, we are here for you!

Our goal is to get you up and running as quickly as possible. If at any point you have a question, a team of applications engineers and our customer service staff are just a phone call away. We are available weekdays from 8am to 5pm Pacific Time at **805-389-1935**. We can also be contacted via email through our website www.a-m-c.com - go to "Contact Us".

4 steps to success!

1 Getting Started What's included with QuickStart and what to expect.	2 5-Minute QuickStart Lets spin the motor!	3 Integrate QuickStart into your System Get your machine working.	4 Going into Production Transitioning from prototype to production.
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This manual has been laid out in four sections to guide you through the process of setting up and integrating your QuickStart system. By following each step in succession you will first be introduced to QuickStart, then hook up the system for a simple bench test, and then integrate QuickStart into your machine and finally transition into the production stage.

Getting Started

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What to Expect

What is 'QuickStart'?

QuickStart is a system offering including: a drive, a motor, all necessary cables, and an interface board with screw terminal connections - all in one box ready for fast delivery!

How many different 'QuickStart' systems are available?

QuickStart systems offer 6 selections with some of our most popular products. This incorporates analog and digital drives for both brushed and brushless motors. These include: 12A8, 30A20AC, B12A6, BX25A20AC, DR100EE20A8BDC and DR100EE15A40NAC. All drives are matched to commercially available motors and cables, with easy interfacing to each other and to a customer's control system.

What purpose does 'QuickStart' serve?

QuickStart is intended to introduce OEMs to Advanced Motion Controls servo drives and provide a positive first experience.

Why is Advanced Motion Controls offering a 'QuickStart' package?

We realize that many OEMs today are faced with trying to get their machinery to market using the fastest possible methods. Our solution is to provide a means by which motion control can be quickly proven.

How does 'QuickStart' benefit potential customers?

QuickStart is designed to make system prototyping easier to include Advanced Motion Controls' servo drives. The attraction to OEM's is a savings of time, money and the personnel needed to move from conception to production. Upon receipt, everything will plug in and operate within 5 minutes. All systems are initially configured in velocity or voltage mode to turn the motor shaft at 30 +/- 20 rpm. This is an indication that when put together, it works out of the box. No pots to tweak or software to configure!

Are the motors in the 'QuickStart' program available for individual resale?

Quite simply, not from Advanced Motion Controls. The motors in these packages are meant to represent what is commonly available from many different manufacturers. Your local Advanced Motion Controls representative can handle requests for motor model information for additional purchases.

How is 'QuickStart' pricing important to me?

Careful selection of systems incorporate popular Advanced Motion Control's drives in order to maximize exposure and minimize costs.

What other considerations should you know about 'QuickStart'?

Although it will be hard to find easy-to-configure systems like these at lower prices anywhere, QuickStart isn't intended for multiple, pre-packaged system selling. Initial exposure to Advanced Motion Controls' drives is the key. Each project will be followed up by our Sales department to determine overall progress and assist in determining the next step.

1

Getting Started



Package Contents

<input type="checkbox"/> Digital Servo Drive	DR100EE20A8BDC
<input type="checkbox"/> Brushless NEMA 34 Motor w/encoder	MBL3408E2
<input type="checkbox"/> Screw Terminal Board	System Interface Board (SIB)
<input type="checkbox"/> Feedback / Commutation Cable (10 foot)	CBL-F02-10
<input type="checkbox"/> Motor Power Cable (10 foot)	CBL-P04-10
<input type="checkbox"/> Drive Cable (1.5 foot)	CBL-D03
<input type="checkbox"/> RS232 Communication Cable	CBL-RS232
<input type="checkbox"/> Documentation	Quick Connect Sheet
	User Manual
	Brochure with CD ROM

Additional Requirements

Item	Notes
Power Supply	Requirements: <ul style="list-style-type: none"> • Output voltage between 20-80VDC • Current output of 10A continuous • Isolation transformer between the AC input and DC output. <p>Selected AMC Power supplies. 1st choice: PS16L80, PS16L72 2nd choice: PS16L60</p> <p>Note: Power Supplies with voltages lower than 80VDC will be speed limited. Speed = [(Supply Voltage – 3.19) / 15] * 1000</p>
Controller	Supported command inputs: <ul style="list-style-type: none"> • +/-10V command signal • Step and Direction • Encoder Following (electronic gearing)
Windows PC	With serial port. To run the DriveSuite software for drive configuration.

5-Minute QuickStart

Let's spin the motor!

This quick setup procedure will get the motor moving in a short amount of time *without the need for a controller*. The drive has been pre-configured for velocity mode with a slight offset. This will turn the motor at a slow steady speed on power-up to demonstrate operation. Once the system is shown to be operational, the next section **Integrating QuickStart into your System** will guide you through the process of integrating the system into your application.

Wiring

On the next page 7 you will find the cables and connections sheet. Use this as a reference when following the steps in this section.

Drive

Connect either end of cable CBL-D03 to the CN2 connector on the drive. Connect the other end to the C2 connector on the system interface board (SIB).

Motor

Connect the white connector on the motor power cable CBL-P04-10 to the corresponding connector on the motor. Connect the other end of the cable to the P3 connector on the drive.

Red	Motor A, P3-1
White	Motor B, P3-2
Black	Motor C, P3-3

Feedback

CBL-F02-10 is the feedback cable. Connect the black connectors and shield drain wire on this cable to the corresponding connectors on the motor. Connect the 15pin D-sub end of this cable to the CN3 connector on the Drive.

System Power

With the power supply turned OFF, connect the main power supply to the supplied green Phoenix connector. **REVERSING THE POLARITY WILL DESTROY THE DRIVE.** High Voltage goes to P2-2 and ground goes to P2-1.

Grounding

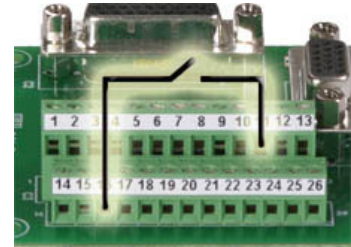
Bring all ground wires to a central point ground such as a ground bus, ground plane or a single ground bolt. Also don't forget to ground the drive chassis! Use the silver screw marked PE on the case.

Motor Ground – The green wire coming from motor power cable is the motor chassis ground. If the motor case is already grounded through direct contact with the machine housing, then leave the green wire disconnected. Grounding the motor at both the green wire and at the motor case causes a ground loop that has been shown to disrupt the feedback signals. Choose one or the other.

5-Minute QuickStart

Inhibit Switch (optional for this section)

A Digital Input has been assigned as the Inhibit function. A switch (not included) can be connected between pins 11 and 16 on the Interface Board to disable power to the motor until you are ready. Opening the switch Enables the drive, closing the switch Disables the drive.



User Interface and RS232 Cable

The user interface and RS232 Cable should not be hooked up for the 5-Minute QuickStart procedure.

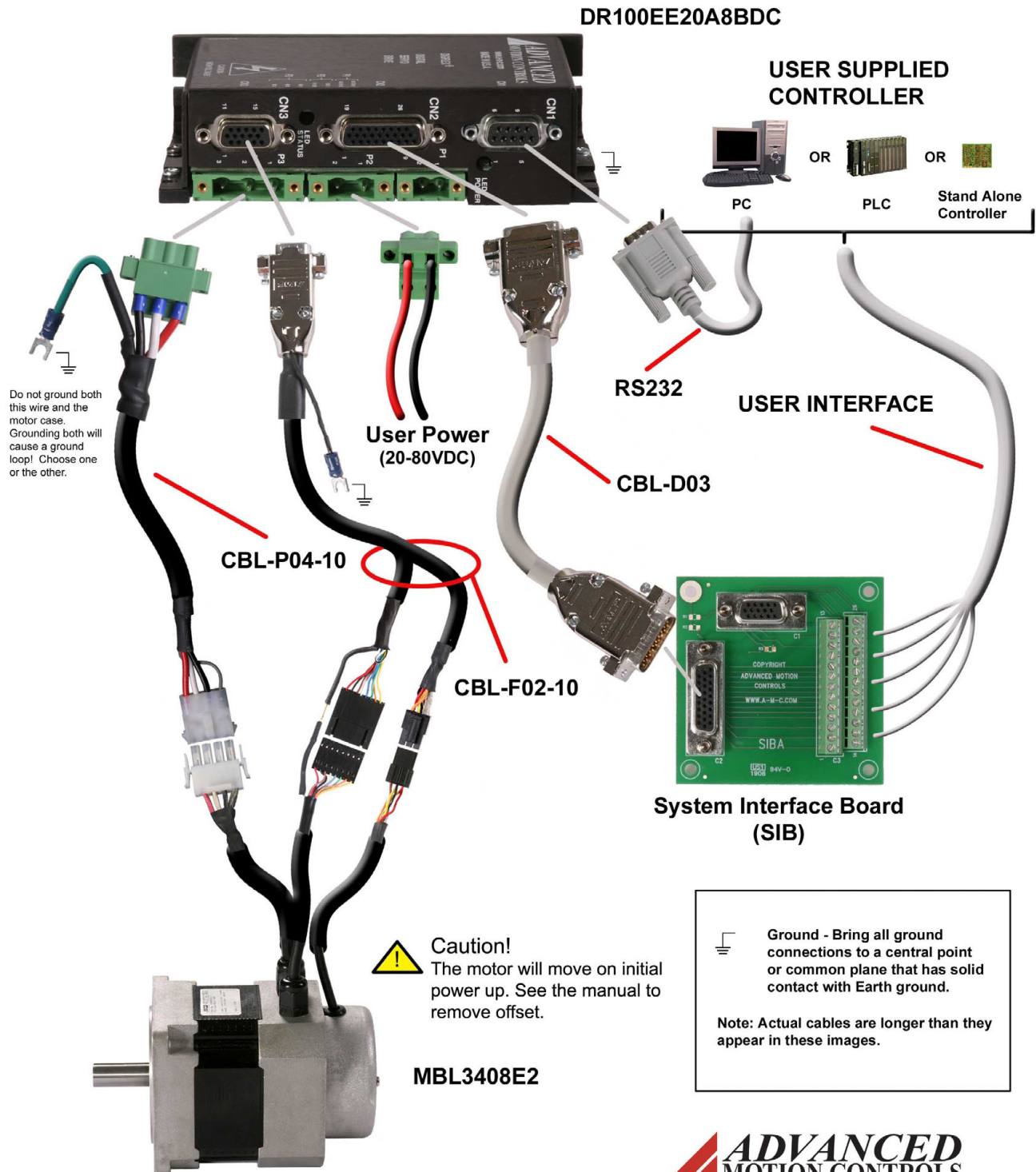
Cautions

Unexpected motion – To avoid the motor from jumping unexpectedly and causing damage, the motor should be secured either with clamps or bolted down using its mounting holes.

Power supply – verify that the power supply is hooked up with the correct polarity. Inverting the polarity will destroy the drive. The power supply must have an isolation transformer.

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Cables and Connections



5-Minute QuickStart

Inhibit Line Test (optional) – Follow this step only if you installed the inhibit switch described in the wiring section on page 6. This is to verify that the optional inhibit switch is functioning and the drive is initially powered up in a disabled state.

1. Disconnect the motor power by unplugging the white connector on CBL-P04-10.
Unplugging this connection allows you to power up the system without the possibility of spinning the motor.
2. Apply power to the drive. Toggle the inhibit switch and verify that you can cause the LED color to switch between Red and Green. Set the switch so the LED is Red.
3. Remove power and reconnect the white connector on CBL-P04-10.

System Power Up

1. Apply power to the drive. *If an inhibit switch has been installed, enable the drive by toggling the inhibit switch so the LED turns Green.*
2. The motor should turn at a slow speed.
3. If the motor turns then the system has been hooked up correctly. Remove power and continue to the next section. If not then go to **Troubleshooting**.
4. To set the motor so it doesn't move, follow the instructions in Section '3b Configuration' to connect to the drive and set the offset to 0.

Troubleshooting

LED not lit.	Verify that power has been applied to the drive.
Motor doesn't have holding torque	Verify that the LED is Green.
LED doesn't turn Green.	Verify all cables are connected. If an Inhibit Switch has been installed, toggle the Inhibit switch.
The drive worked for a little bit then disabled.	For safety purposes, the drive has been configured to disable if there is too much noise on the feedback signal. Poor system grounding is the primary cause for excessive noise. First, verify that the system is properly grounded, then cycle power.
Contact Factory - If you can't get the motor turning within a few minutes, please call and ask for technical support! 805-389-1935. We want to get you up and running quickly!	

3a Wiring



Integrate QuickStart into your System

The following instructions are a continuation of the **5-Minute QuickStart**. This section explains controller wiring, drive configuration, drive mounting, motor mounting, SIB mounting and load coupling.

Signal Ground

Almost all signals between the drive and the controller are referenced to signal ground. Without this reference, the drive and the controller would not be able to transmit signals to each other. To ensure that the signals between the drive and the controller are referenced to the same potential, the signal grounds on the controller and the drive must be connected together. This is especially important for:

- Single ended command signals
- Inhibit line
- Other inputs and outputs.

You will need to identify the signal ground on your controller and connect it to the signal ground on the drive. For your convenience, the Signal Ground is accessible at two locations on the SIB. However, to avoid ground loops there should only be one connection between the drive signal ground and the controller signal ground. Don't add a connection if there is already continuity between the two grounds.

Available Signal Ground Locations on the SIB

Controller	SIB
Signal Ground	C3-2 (SGND)
	C3-16 (SGND)

Command Signal

Command signal and mode selection are dictated by the capabilities of your controller and the desired operation of your system. Analog command signals are suited for torque and velocity modes, while digital command signals such as Step & Direction and Encoder Following are associated with Position mode.

+/-10V Command Signal (Single Ended)

Signal	SIB	Available Drive Modes
SGND	C3-2 (SGND)	Torque Mode, Velocity Mode
Command	C3-4 (Ref+)	

+/-10V Command Signal (Differential)

Signal	SIB	Available Drive Modes
Command +	C3-4 (Ref+)	Torque Mode, Velocity Mode
Command -	C3-5 (Ref-)	

3a Wiring

Integrate QuickStart into your System



Step & Direction

Signal	SIB	Available Drive Mode
Step+	C3-17 (+PDI5)	Position Mode
Step-	C3-26 (-PDI5)	
Direction+	C3-18 (+PDI6)	
Direction-	C3-9 (-PDI6)	

Encoder Following

Signal	SIB	Available Drive Mode
Channel A	C3-17 (+PDI5)	Position Mode
Channel A-	C3-26 (-PDI5)	
Channel B	C3-18 (+PDI6)	
Channel B-	C3-9 (-PDI6)	

More Information on Mode Selection

Drive modes can be separated into three basic categories: Torque, Velocity and Position. The name of the mode describes what servo loops are being closed in the drive. They don't describe the end-result of the operation. For example, a drive in Torque mode can still be in a positioning application if the external controller closes the position loop. In fact, most high performance positioning systems use a drive in torque mode with the controller closing the velocity and position loops.

The correct mode is determined by the requirements of the controller. Some controllers require that the drive be in torque mode. Other controllers require that the drive be in velocity mode. Check the documentation on your controller or contact the manufacturer of your controller to determine the correct mode for your drive.

Once the command signal and mode have been selected, connect the controller to the signals as indicated in the above tables. The proper gains and command settings must also be configured using the DriveSuite Software. Software configuration is explained later in this section.

3a Wiring



Integrate QuickStart into your System

Drive Inhibit (recommended)

The inhibit line is used to turn off power to the motor while the drive is still powered on. Sometimes this is necessary if power to the motor needs to be removed quickly or if the user needs to manually move the load in a freewheeling condition. If your controller has an inhibit function then we highly recommend that you use it.

Inhibit Connection

Controller	SIB
Inhibit	C3-11 (PDI1)

Note: The inhibit input is configured to disable the drive when pulled low (active low). The control logic can be inverted by setting it to active high in the DriveSuite software.

Feedback

The feedback on the motor is an incremental encoder with two Channels (A and B) and an Index (I). The signals are differential but are compatible with single ended circuitry (simply leave the complimentary signals open A-, B- and I-). The resolution is 10000 counts per revolution (quadrature).

Power Requirements - Encoder power is supplied by the drive. 5VDC @ 125mA.

The screw terminals on the System Interface Board (SIB) provide easy access to the encoder signals.

Encoder Connection

Signal	SIB
Channel A+	C3-20
Channel A-	C3-21
Channel B+	C3-22
Channel B-	C3-23
Channel I+	C3-24
Channel I-	C3-25

Integrate QuickStart into your System

Drive Mounting

Mounting Dimensions can be found in the drive datasheet in the Appendix.

The drive can be mounted flat against the base plate or along the spine.

Mounting the drive flat on the base plate against a large thermally conductive surface for cooling will provide the most natural heat dissipation for the drive. A metal back plane in a cabinet on the machine often makes a good surface.

Drives mounted on the spine can be mounted next to each other. Maintain a minimum separation of 1 inch between drives to provide adequate convection cooling.

Note: Additional cooling may be necessary to dissipate the heat generated by the drive depending on ambient temperatures, duty cycle and natural ventilation.

Motor Mounting

Mounting Dimensions can be found in the motor datasheet in the Appendix.

The mounting surface must be stiff enough so it does not deflect when radial loads are applied to the motor shaft. The mounting surface should also have good thermal conductivity, especially if peak performance is demanded of the motor.

SIB Mounting

Mounting Dimensions can be found in the SIB datasheet in the Appendix.

The SIB can be mounted using the mounting holes or a DIN tray such as from Phoenix Contact. If using the mounting holes, standoffs must be used to keep the bottom of the SIB from shorting with the mounting surface.

Cable Routing

Cable Datasheets can be found in the Appendix.

QuickStart cables come with excellent shielding and make proper grounding easy. This makes proper cable routing less critical, however proper routing practices should still be followed.

Route cables to minimize length and minimize exposure to noise sources. The motor power wires are a major source of noise and the motor feedback wires are susceptible to receiving noise. This is why it is never a good practice to route the motor power wires close to the motor feedback wires even if they are shielded. Although both of these cables originate at the amplifier and terminate at the motor, try to find separate paths that maintain distance between the two. A rule of thumb for the minimum distance between these wires is 1cm for every 1m of cable length.

3a Wiring



Integrate QuickStart into your System

Grounding

Bring all ground wires to a central point ground such as a ground bus, ground plane or a single ground bolt.

Motor Ground – The green wire coming from CBL-P04-10 is for the motor case ground. If the motor case is already grounded through direct contact with the machine housing, then leave the green wire disconnected. Grounding the motor at both the green wire and at the motor case causes a ground loop that has been shown to disrupt the encoder signals. Choose one or the other.

Load Coupling

A non-rigid coupling must be used between the motor shaft and the load to minimize mechanical stress due to radial loads, axial loads or misalignment. If you feel that the radial load on the motor is excessive, you may want to consider connecting the motor to an idler shaft that is supported by pillow block bearings (or similar). Then the load can be coupled to the idler shaft without risking damage to the motor bearings.

3b Configuration

Integrate QuickStart into your System



Configuration / Software

Advanced Motion Controls DR Series DigiFlex® Servo Drives are configured using the DriveSuite configuration software. DriveSuite can be found on the CD ROM that came with your QuickStart package or it can be downloaded from the Advanced Motion Controls website at

www.a-m-c.com/download/software/amcds3-5.zip.

The basic setup of DigiFlex® servo drives is designed to be user friendly. These instructions will walk you through the steps necessary to configure your drive to your system:

- Connect to the drive
- Configure the drive mode.
 - Torque
 - Velocity
 - Set Velocity Limits
 - Position
 - Set Position Limits

Save your project often to the Drive Suite\My Projects directory.

Assistance for topics not covered in this guide is available through any of the following:

- DriveSuite Help files
- www.a-m-c.com
- Technical Assistance via phone: 805-389-1935

Technical Assistance via e-mail: techsupport@a-m-c.com.

Note: The full version of the Software Start-Up Guide can be found on the Advanced Motion Controls website under 'Support/Digital/100series'. It is not needed but could be of benefit for more complete configuration/diagnostic instructions.

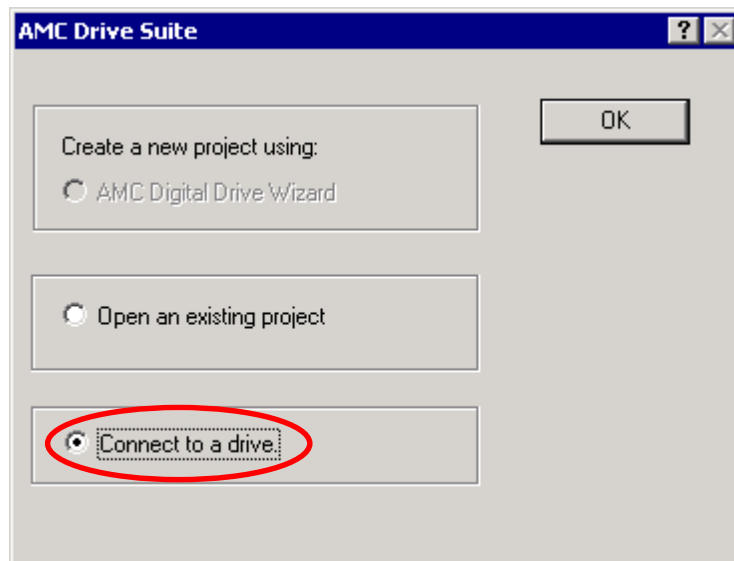
3b Configuration

Integrate QuickStart into your System

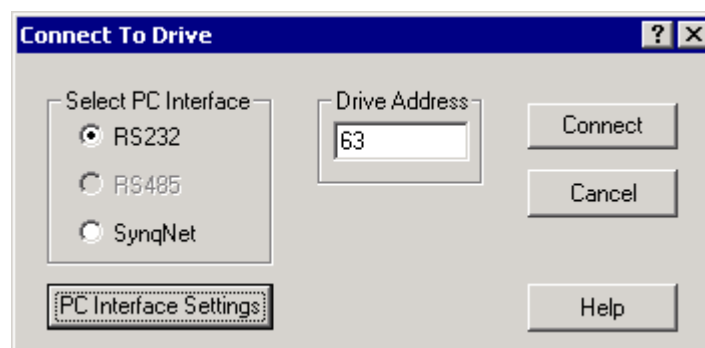


Connect to the Drive

1. Install the AMC DriveSuite software onto your PC. Follow instructions to assure complete installation.
2. Connect an available RS-232 communications port on your PC to the serial interface on the drive. Use the cable provided with your QuickStart system.
3. If desired, connect the Inhibit/Enable circuit as described in the QuickStart User Manual.
4. Apply power to the drive.
5. Double click on the AMC_DriveSuite.exe icon to start the setup software.
6. At the opening screen, select *Connect to a drive* and click "OK".

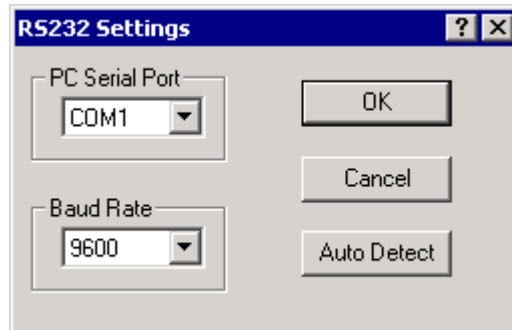


7. Select *PC Interface Settings* and set the appropriate communications parameters to connect to the drive. Use the default settings (COM1, 9600) or, if the interface settings are unknown, select *Auto Detect*.

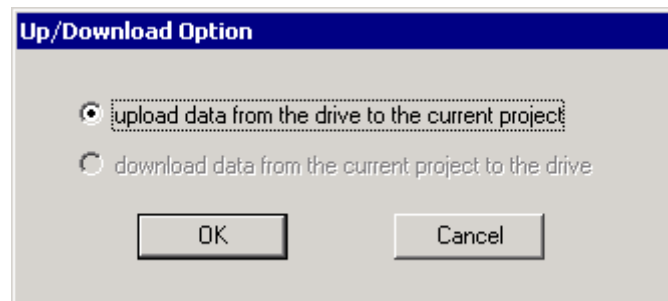


3b Configuration

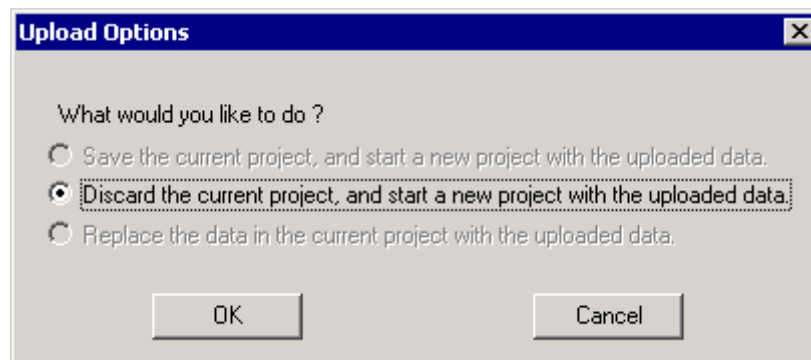
Integrate QuickStart into your System



8. If connecting for the first time, select *Upload data from the drive to the current project*



9. The Upload Options window provides options on whether to *Save the current* DriveSuite project before uploading from the drive; *Discard the current* DriveSuite project before uploading from the drive; or upload the data from the drive to *Replace the data* in the current DriveSuite project. If connecting to a drive immediately after starting DriveSuite, the only available option is to *Discard the current project and start a new project with the uploaded data*.





Note: You are now connected to the drive. The status indicators on the bottom right corner of the DriveSuite main window should indicate "CONNECTED."

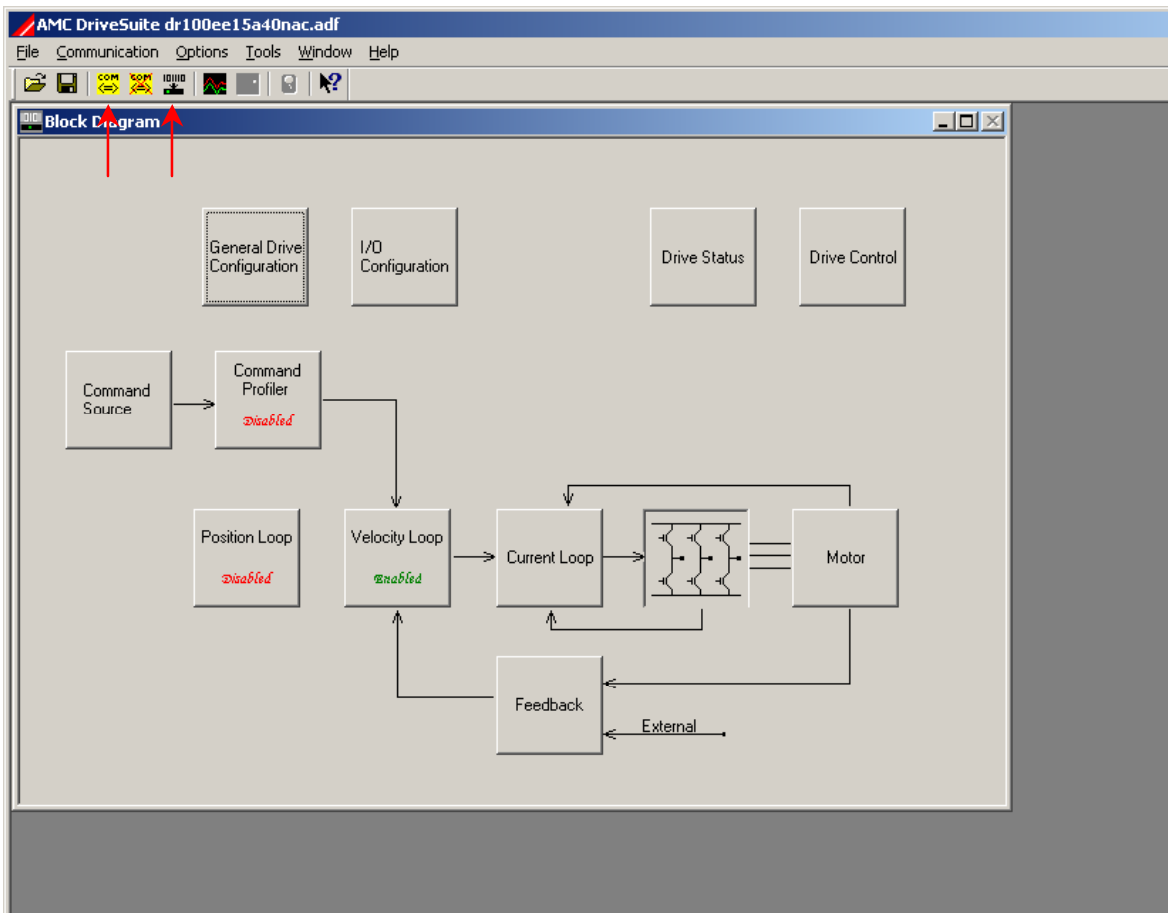
3b Configuration

Integrate QuickStart into your System



10. To change the RS-232 communications baud rate, perform the following steps:
- On the Menu bar, select *Communication* → *Connect* (or click the *Connect* icon )
 - Click the *PC Interface Settings* button to open the RS-232 Settings window.
 - Select the appropriate baud rate.
 - Click *Connect* in the Drive Connection Window to set the selected baud rate.
 - On the Menu Bar, select *Communication* → *Store* (or click the *Store Settings* icon ) , then OK to store parameters to the drive nonvolatile memory.

Note: Some PC's may not communicate reliably at higher baud rates. If increasing the communications baud rate results in communications errors, use a lower rate.



This is a screen shot of the DriveSuite software with the Block Diagram screen shown.

3b Configuration

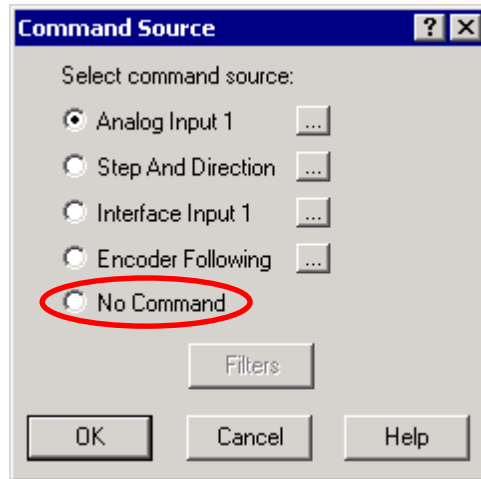
Integrate QuickStart into your System



Drive Mode Configuration

The drive has been configured with an offset to make the motor turn without a command. Before you configure the drive, remove the offset so the motor doesn't keep turning.

In the Block Diagram window, select the *Command Source* block.



1. Select No Command
2. Click *OK* on the Command Source window.

Note: *No Command* is designed to be a non-operation input source. If the drive is in velocity or current mode, *No Command* will always provide a command of zero. If the drive is in position mode, when the command is set to *No Command* the drive sets *Position Target* equal to the *Position Measured* to prevent sudden motion.

Enable/Disable

The drive can be enabled and disabled by clicking the  icon in the toolbar.

You are now ready to configure the drive for your system:

Torque Mode
page 18

Velocity Mode
page 22

Position Mode
The Velocity loop must be tuned first, page 22. Then the drive can be set in Position Mode, page 29.

3b Configuration (Torque Mode)

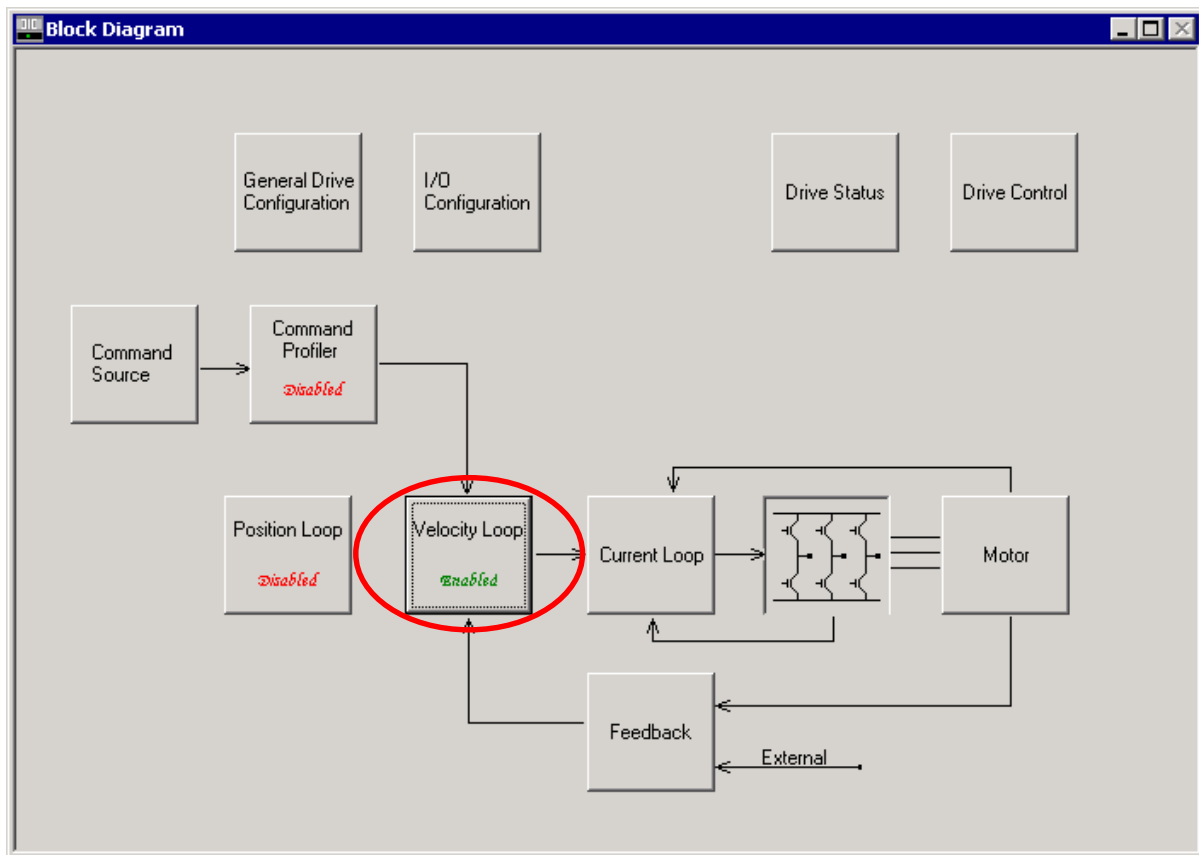
Integrate QuickStart into your System



Torque Mode

Your QuickStart drive has been configured in Velocity mode. To go into torque mode simply disable the Velocity loop.

1. In the block diagram, select the Velocity Loop block.

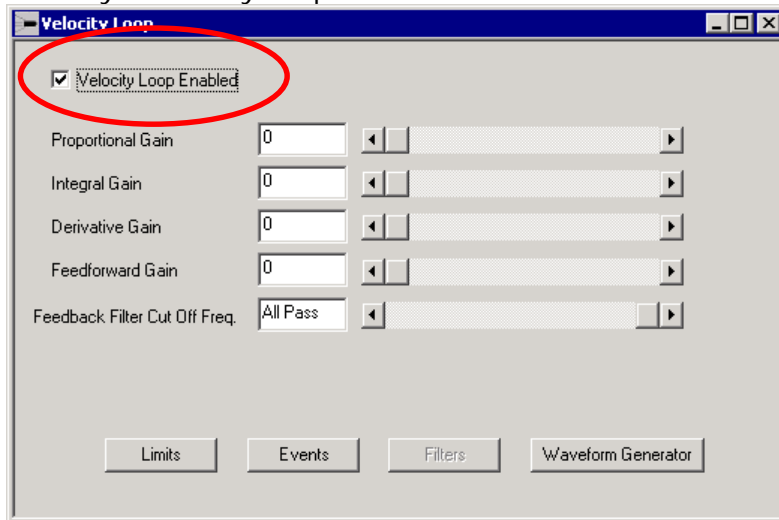


3b Configuration (Torque Mode)

Integrate QuickStart into your System



2. This opens the Velocity Loop screen. To disable the velocity loop, uncheck the box that says "Velocity Loop Enabled". Close the screen.



Command Source Selection for Torque Mode

In the Block Diagram window, select the *Command Source* block.



1. Select Analog Input 1
2. Click *OK* on the Command Source window.


Note: *No Command* is designed to be a non-operation input source. If the drive is in velocity or current mode, *No Command* will always provide a command of zero. If the drive is in position mode, when the command is set to *No Command* the drive sets *Position Target* equal to the *Position Measured* to prevent sudden motion.

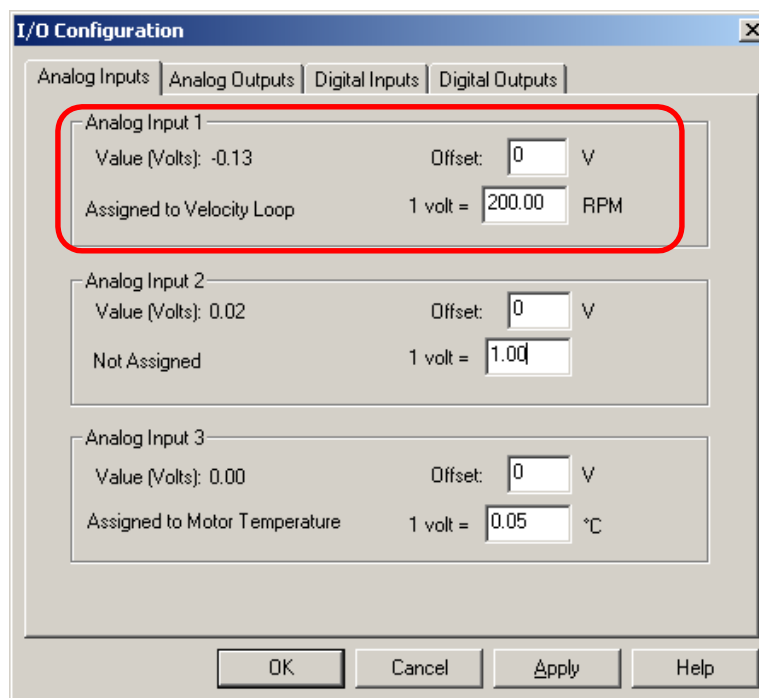
3b Configuration (Torque Mode)

Integrate QuickStart into your System



Analog Input Scaling

- Set the analog command scaling as follows:
 - In the Block Diagram window, select *I/O Configuration*.
 - For the appropriate Analog Input, (as previously selected,) set the required scaling (e.g. Amps/Volt) and command offset voltage.
 - Command polarity can be inverted by changing the sign (+/-) on the Analog Input scaling. In the screen below one would enter '-200.00' to reverse the polarity.
 - Click *Apply* or *OK* to set any modified values.
- On the Menu Bar, select *Communication* → *Store* (or click the *Store Settings* icon ) , then OK to store parameters to the drive nonvolatile memory.
- The Analog Input may now be used to apply a current command to the drive.



The image shows a screenshot of the 'I/O Configuration' dialog box. It has four tabs: 'Analog Inputs', 'Analog Outputs', 'Digital Inputs', and 'Digital Outputs'. The 'Analog Inputs' tab is selected. There are three sections for 'Analog Input 1', 'Analog Input 2', and 'Analog Input 3'. A red rectangle highlights the 'Analog Input 1' section. In this section, 'Value (Volts)' is -0.13, 'Offset' is 0 V, 'Assigned to Velocity Loop' is checked, and '1 volt = 200.00 RPM'. The 'Analog Input 2' section shows 'Value (Volts)' as 0.02, 'Offset' as 0 V, 'Not Assigned' is checked, and '1 volt = 1.00'. The 'Analog Input 3' section shows 'Value (Volts)' as 0.00, 'Offset' as 0 V, 'Assigned to Motor Temperature' is checked, and '1 volt = 0.05 °C'. At the bottom are buttons for 'OK', 'Cancel', 'Apply', and 'Help'.

Input	Value (Volts)	Offset	Assigned to	1 volt =
Analog Input 1	-0.13	0 V	Assigned to Velocity Loop	200.00 RPM
Analog Input 2	0.02	0 V	Not Assigned	1.00
Analog Input 3	0.00	0 V	Assigned to Motor Temperature	0.05 °C

Further assistance is available through any of the following:

- DriveSuite Help files
- www.a-m-c.com
- Technical Assistance via phone: 805-389-1935
- Technical Assistance via e-mail: techsupport@a-m-c.com.

3b Configuration (Velocity Mode)

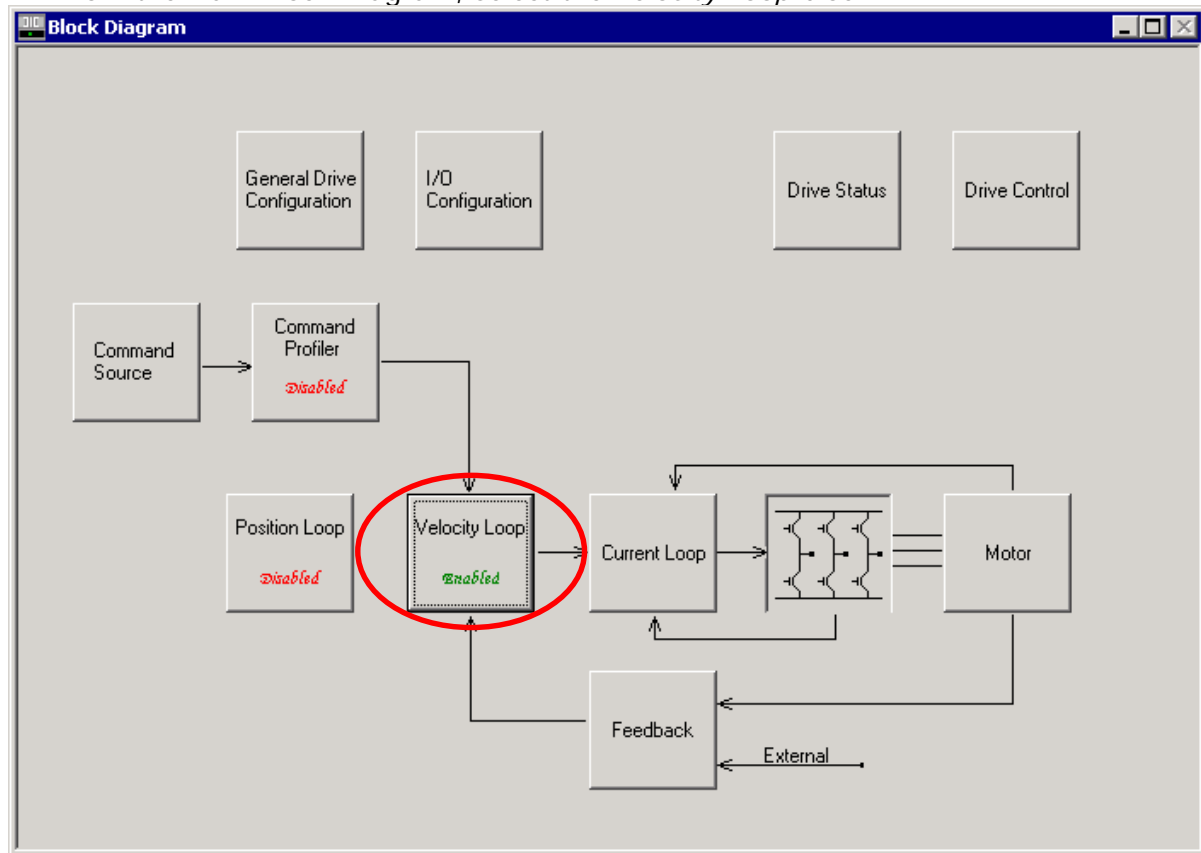
Integrate QuickStart into your System



Velocity Mode

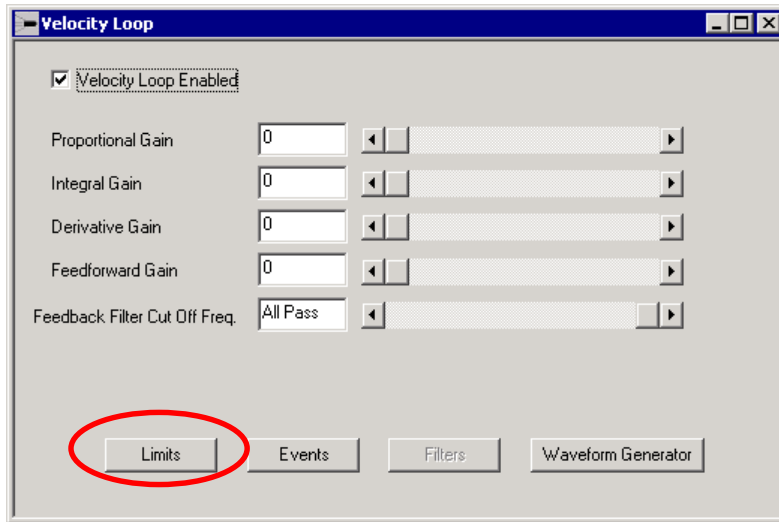
Your QuickStart drive is already in Velocity Mode, however since velocity loop tuning is dependent on the mechanical load, velocity loop tuning should be performed with the motor installed in the system, connected to the load.

1. Verify that the drive is disabled (🚫).
2. From the Main Block Diagram, select the *Velocity Loop* block.

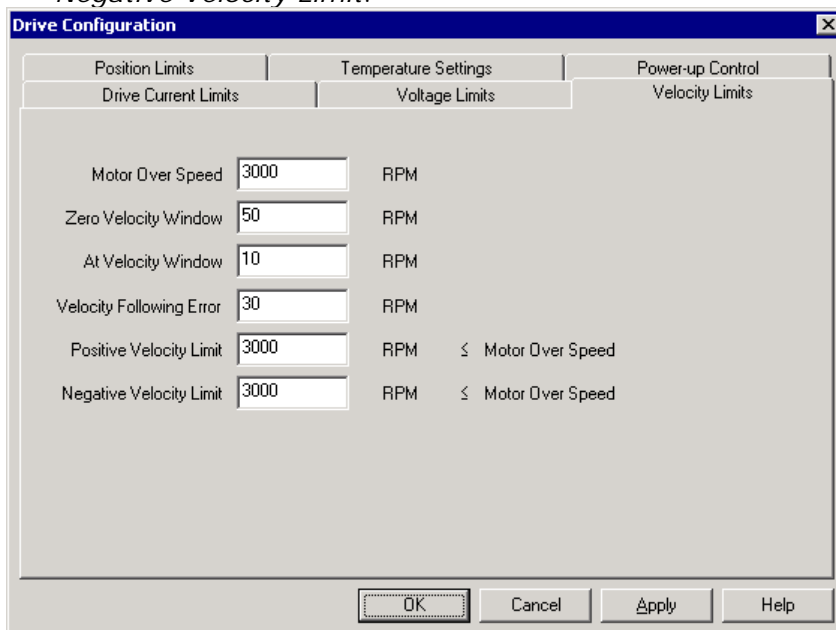


3. In the *Velocity Loop* window, click the *Limits* button to open the *Velocity Limits* tab in *General Drive Configuration*.

3b Configuration (Velocity Mode) Integrate QuickStart into your System



4. Enter values for *At Velocity Window*, *Velocity Following Error*, *Positive Velocity Limit*, and *Negative Velocity Limit*.



Note: Velocity limit values cannot exceed the Maximum Speed rating of the motor (from the Motor Data window).

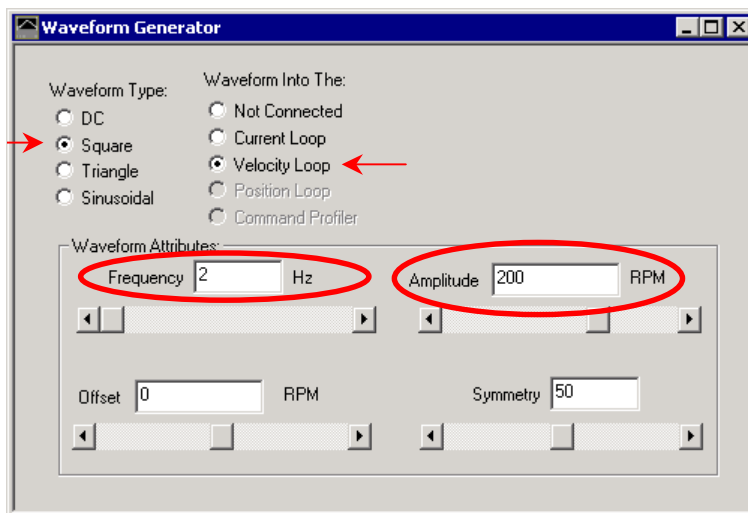
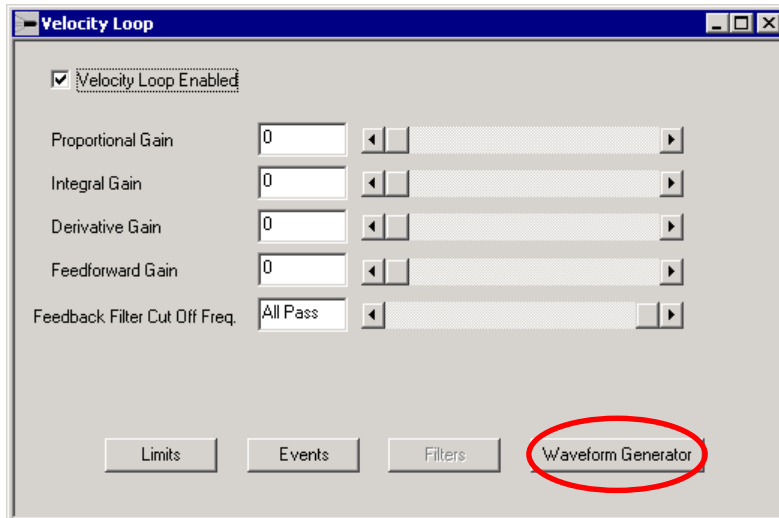
5. Click "OK" to accept values and close *General Drive Configuration*.


3b Configuration (Velocity Mode)

Integrate QuickStart into your System



6. In the *Velocity Loop* window, click the *Waveform Generator* button to open the Waveform Generator.




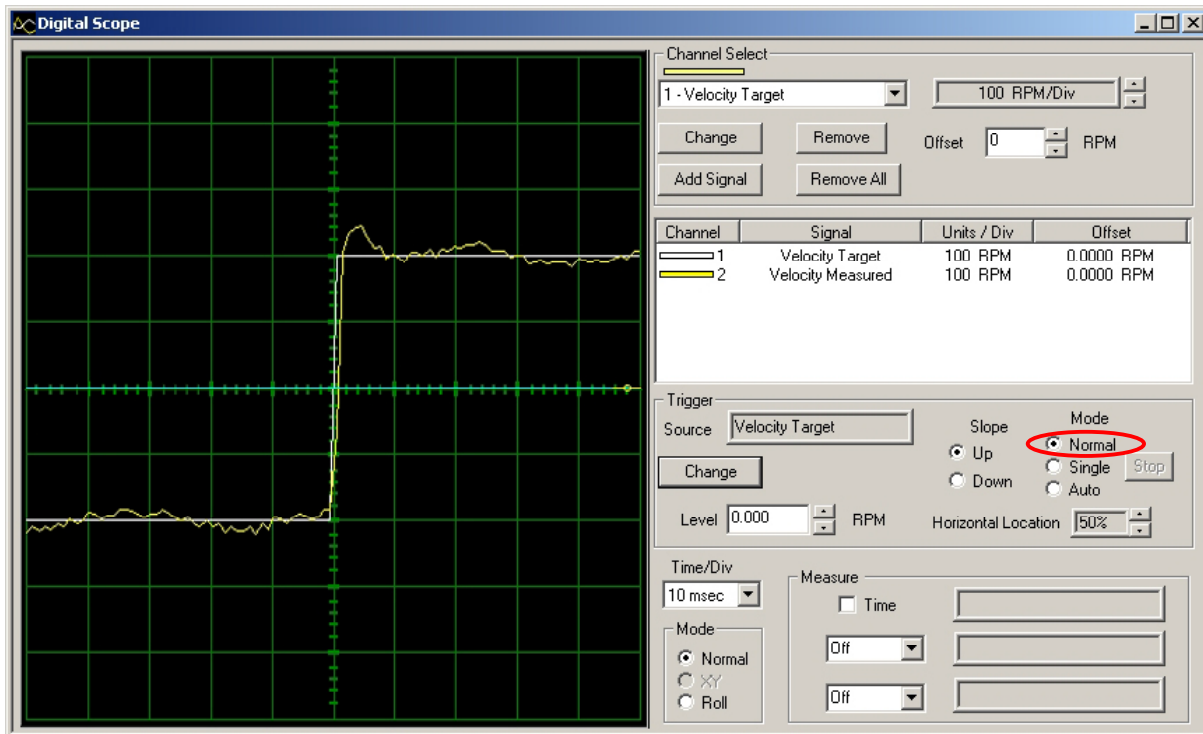
7. With the Waveform Generator, establish a *Square* wave into the *Velocity Loop* with an amplitude of approximately 10% of nominal motor speed. The *Frequency* should be slow enough to achieve the commanded velocity, but fast enough to prevent the system from reaching a mechanical limit (e.g.: 1-3Hz).
Note: The accuracy of velocity loop tuning is dependent on the quality and resolution of the velocity feedback. Sources with relatively low resolution or higher noise will require tuning at a higher velocity in order to overcome the effects of these limitations. It is best to experimentally determine the optimum tuning setup.
8. On the menu bar, select *Tools* → *Oscilloscope* to open the digital oscilloscope (or click the Oscilloscope icon ) Set up the scope view as follows:
- In the *Channel Select* area of the scope, use the *Change*, *Add Signal*, and *Remove* buttons as necessary to set the *Velocity Target* and the *Velocity Measured* signals on Channels 1 and 2.
 - In the *Trigger* area of the scope, use the *Change* button as necessary to establish *Velocity Target* as the Trigger Source at a level of zero RPM, Up Slope.

3b Configuration (Velocity Mode)

Integrate QuickStart into your System





9. Ensure Trigger Mode is *Normal*
10. Enable the drive by clicking the *Enable/Disable Drive* icon .



11. Use the *Proportional Gain*, *Integral Gain*, *Derivative Gain*, *Feedforward Gain*, and *Feedback Filter Cut Off Frequency* sliders or arrow buttons to adjust the *Velocity Measured* waveform on the oscilloscope and match the *Velocity Target* as closely as possible, but with 10-20% overshoot on the leading edge.

Note: While reducing the value of the *Feedback Filter Cut Off Frequency* can be used to minimize the effects of noise and enhance stability, a higher value will increase system response and bandwidth. The final tuning must be empirically determined as a compromise between the two results. The effect of the *Feedback Filter Cut Off Frequency* can be seen by comparing the *Velocity Feedback* (unfiltered) and *Velocity Measured* (filtered) signals on the oscilloscope.

12. When tuning is complete, disable the drive with the *Enable/Disable Drive* icon  and select *Not Connected* on the Waveform Generator.
13. On the Menu Bar, select *Communication* → *Store* (or click the *Store Settings* icon ) , then OK to store parameters to the drive nonvolatile memory.

*****Note for Position Mode applications the Velocity Loop is now sufficiently tuned. You can now proceed to Position Mode configuration page 29.**

For Velocity Mode applications continue onto the next page.

3b Configuration (Velocity Mode)

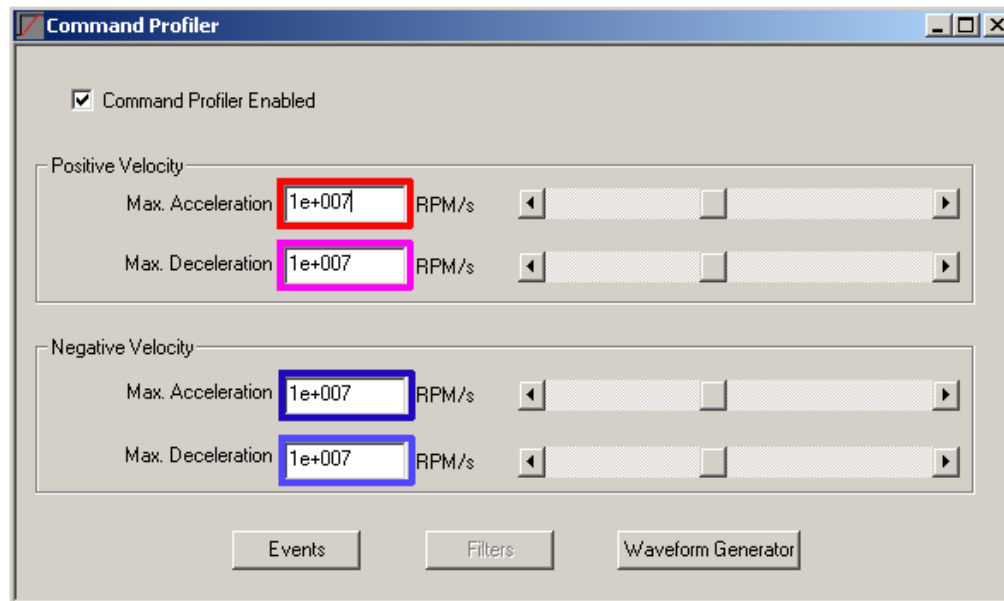
Integrate QuickStart into your System



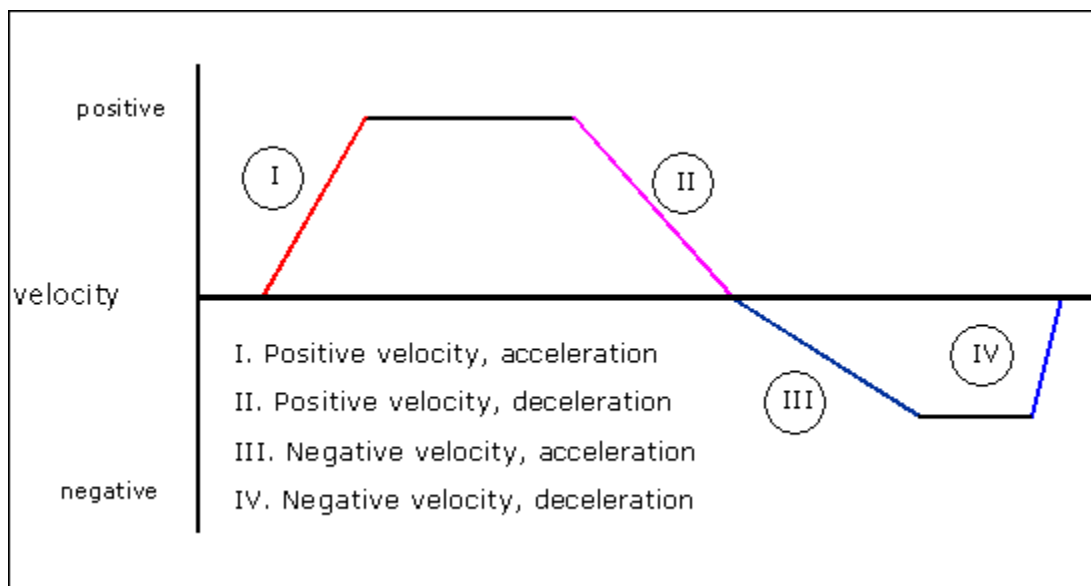
Velocity Loop Command Profiling

While in velocity mode, Velocity Loop Command Profiling can be used to limit the rate of change of velocity or apply a constant acceleration to step velocity commands. The command profiler provides independent control of acceleration and deceleration in both the positive and negative velocity directions.

1. From the Main Block Diagram, open the *Command Profiler*.



2. Activate the check box for *Command Profiler Enabled*.
3. Using the slider bars or numerical entry, enter values for the maximum rates of change in velocity (RPM/sec). Independent values can be entered for both acceleration and deceleration in both the positive and negative directions.



3b Configuration (Velocity Mode)

Integrate QuickStart into your System



Command Source Selection

1. Select the command source as follows:
2. In the Block Diagram window, select the *Command Source* block.



3. Select Analog Input
4. Click *OK* on the Command Source window.


Note: *No Command* is designed to be a non-operation input source. If the drive is in velocity or current mode, *No Command* will always provide a command of zero.

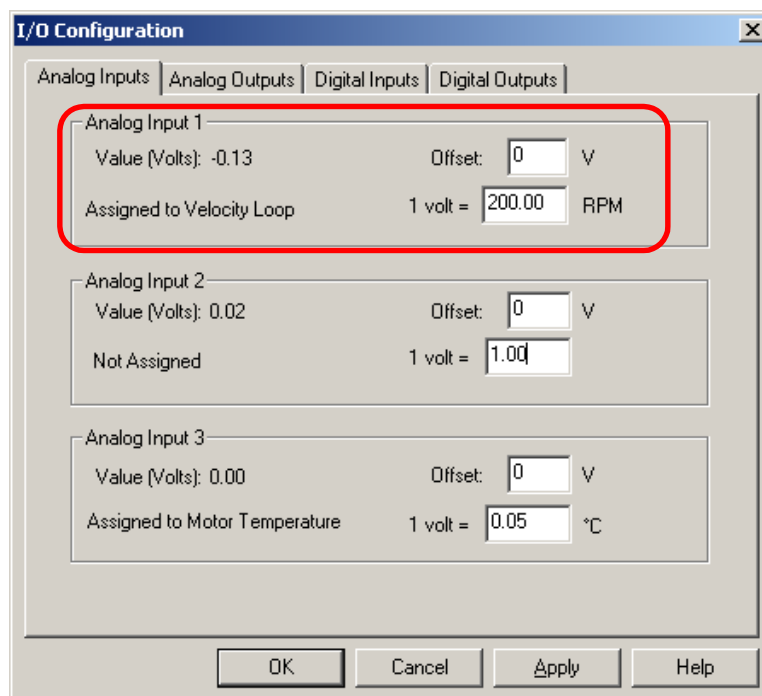
3b Configuration (Velocity Mode)

Integrate QuickStart into your System



Analog Input Scaling

- Set the analog command scaling as follows:
 - In the Block Diagram window, select *I/O Configuration*.
 - For the appropriate Analog Input, (as previously selected,) set the required scaling (e.g. RPM/Volt) and command offset voltage.
 - Command polarity can be inverted by changing the sign (+/-) on the Analog Input scaling.
 - Click *Apply* or *OK* to set any modified values.
 - On the Menu Bar, select *Communication* → *Store* (or click the *Store Settings* icon ) , then OK to store parameters to the drive nonvolatile memory.
- The Analog Input may now be used to apply a velocity command to the drive.



Further assistance is available through any of the following:

- DriveSuite Help files
- www.a-m-c.com
- Technical Assistance via phone: 805-389-1935
- Technical Assistance via e-mail: techsupport@a-m-c.com.

3b Configuration (Position Mode)

Integrate QuickStart into your System

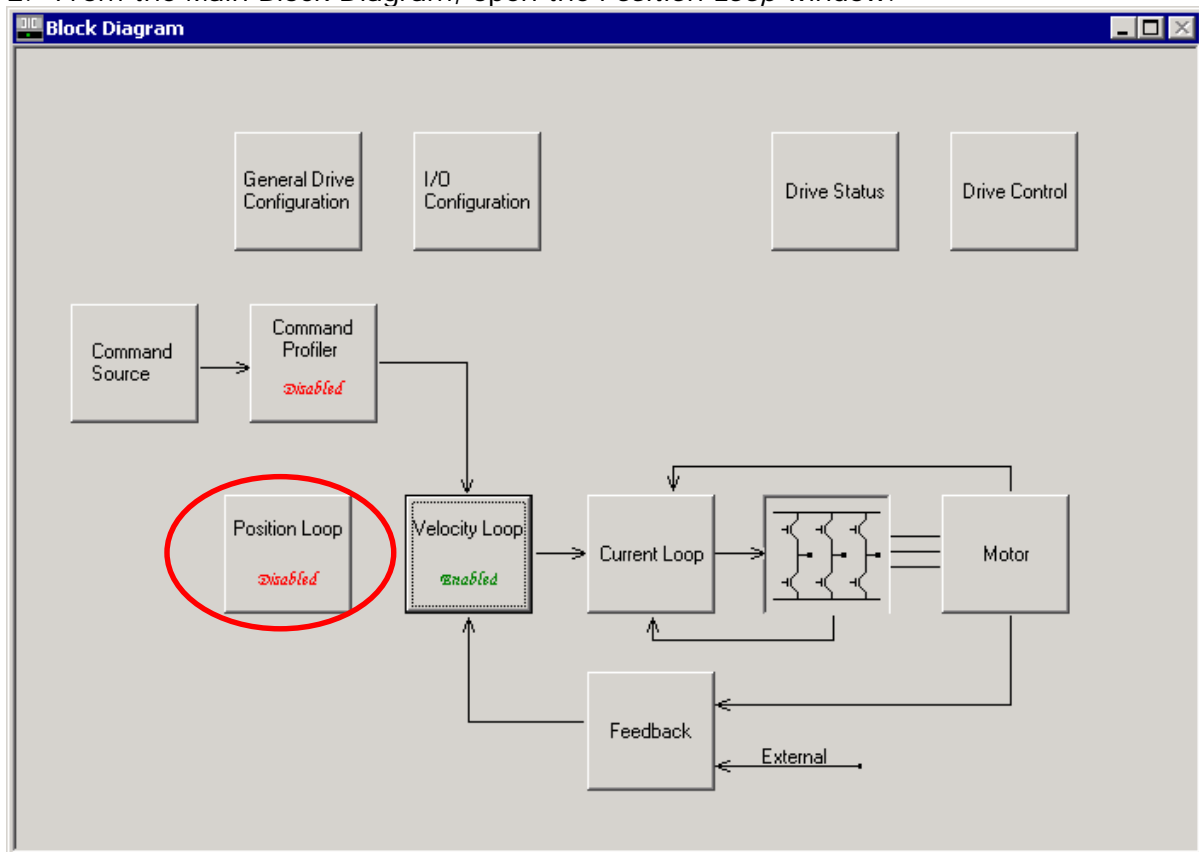


Position Mode

Before the drive can be configured in Position Mode, the Velocity Loop must be tuned. Follow the instructions for Velocity Mode configuration first.

Position loop tuning is dependent on the mechanical load of the motor and, therefore will change with any mechanical system changes. Position loop tuning should be performed with the motor installed in the system.

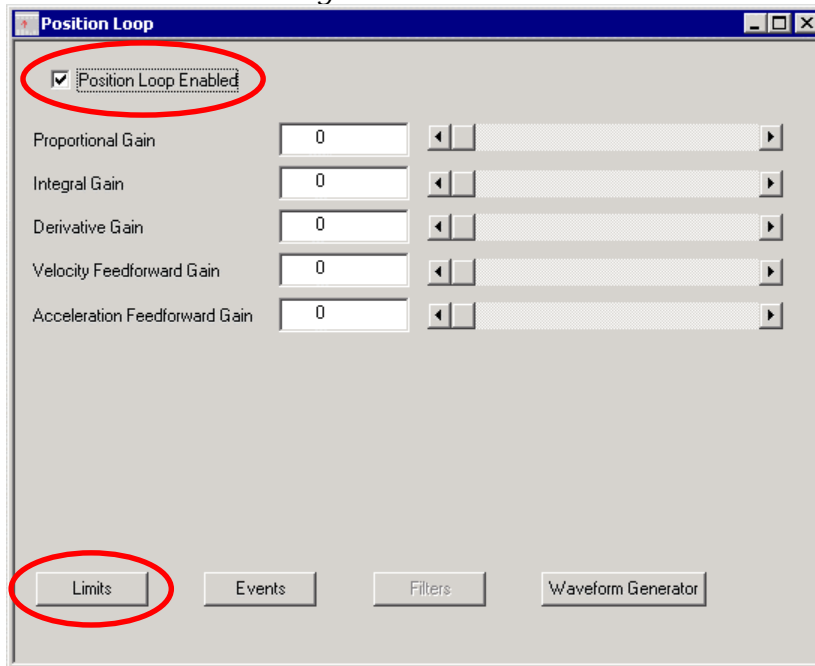
1. Verify that the drive is disabled (🚫).
2. From the Main Block Diagram, open the *Position Loop* window.



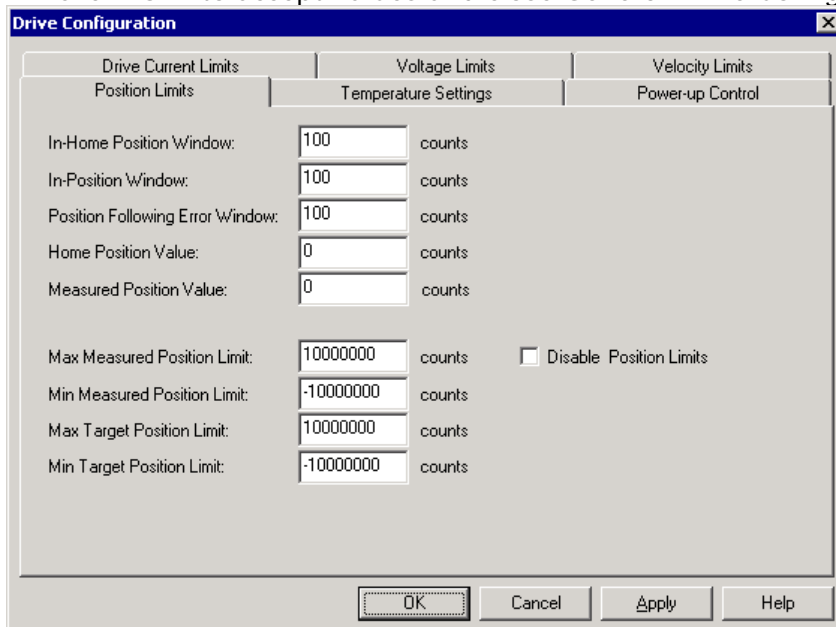
3b Configuration (Position Mode) Integrate QuickStart into your System



3. Select the check box for *Position Loop Enabled*.
4. In the *Position Loop* window, click the *Limits* button to open the *Position Limits* tab in *General Drive Configuration*.



5. Enter values for *In Position Window*, *Position Following Error Window*, and *Max and Min Target Position Limit*.
6. Set the *Measured Position Value* to zero (0) counts.
7. Click "OK" to accept values and close *General Drive Configuration*.



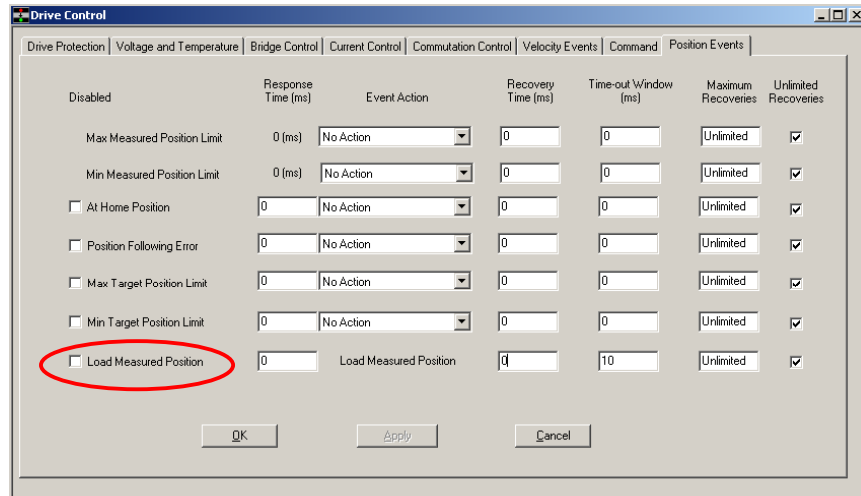
3b Configuration (Position Mode)

Integrate QuickStart into your System

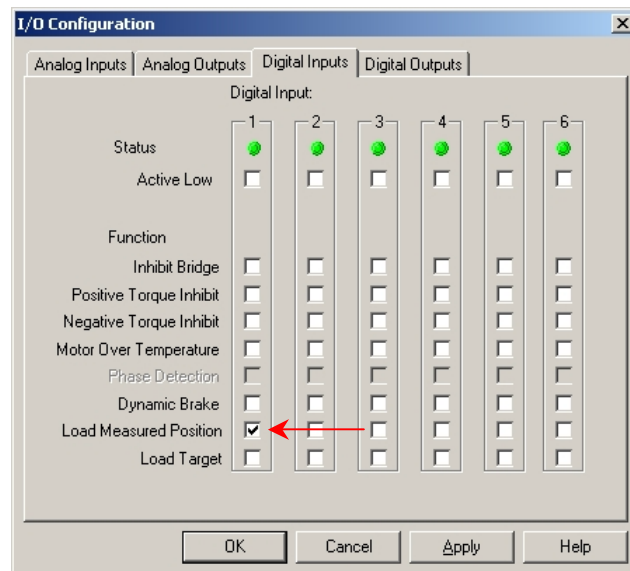


Caution: The drive has been configured to disable due to a following error if the Measured Position doesn't match the Target Position. A following error is very likely if you have been running the motor in Velocity mode and then switched to Position mode. To set the Measured Position equal to the Target Position you can load the Measured Position into the Target.

8. Open *Drive Control* to the *Position Events* tab and ensure that the *Load Measured Position* event is not checked.



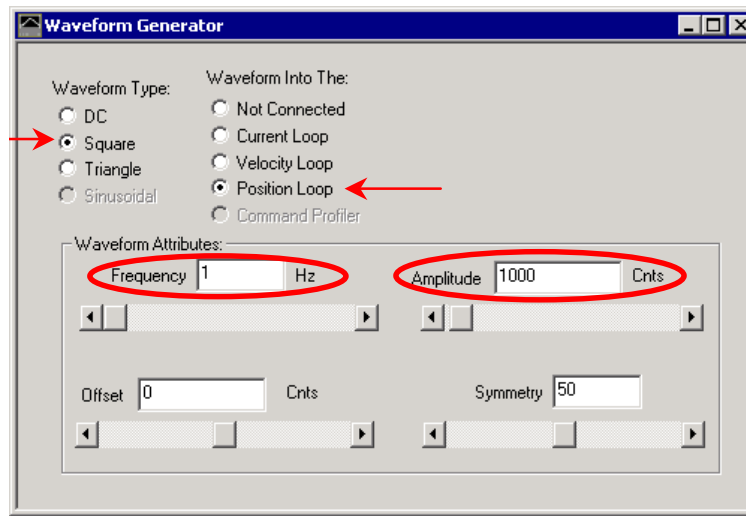
9. From the Main Block Diagram, click *I/O Configuration* and select the *Digital Inputs* tab.
10. Set the Measured Position to zero by checking *Load Measured Position* under an unassigned input and click the *Apply* button.



11. Clear the *Load Measured Position* check box and once again click *Apply*.
12. Click OK to close the *I/O Configuration* window. (The measured now equals the target).
13. In the *Position Loop* window, click the *Waveform Generator* button to open the Waveform Generator.

3b Configuration (Position Mode)

Integrate QuickStart into your System




14. With the Waveform Generator, establish a *Square* wave into the *Position Loop* with an amplitude of approximately 1000-1500 counts. The frequency should be slow enough to allow the motor to settle in position (e.g. 1-2Hz).

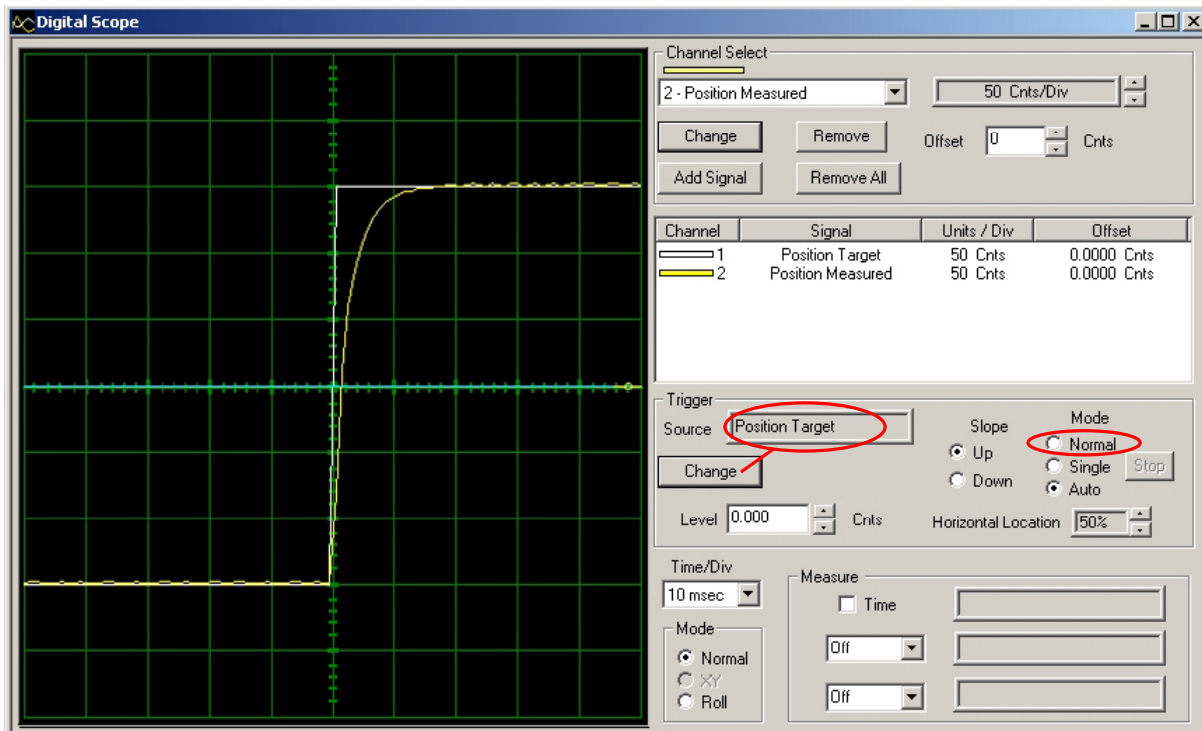
Continued...




3b Configuration (Position Mode)

Integrate QuickStart into your System



15. On the menu bar, select Tools → Oscilloscope to open the digital oscilloscope (or click the Oscilloscope icon ) Set up the scope view as follows:
 - a. In the *Channel Select* area of the scope, use the *Change*, *Add Signal*, and *Remove* buttons as necessary to set the *Position Target* and the *Position Measured* signals on Channels 1 and 2.
 - b. In the *Trigger* area of the scope, use the *Change* button as necessary to establish *Position Target* as the Trigger Source at a level of zero Counts, Up Slope.
16. Ensure Trigger Mode is *Normal*.



17. Enable the drive by clicking the *Enable/Disable Drive* icon .
18. Use the *Proportional Gain*, *Integral Gain*, *Derivative Gain*, *Velocity Feedforward Gain*, and *Acceleration Feedforward Gain* sliders or arrow buttons to adjust the *Position Measured* waveform on the oscilloscope and match the *Position Target* as closely as possible.
19. When tuning is complete, disable the drive with the *Enable/Disable Drive* icon  and select *Not Connected* on the Waveform Generator.
20. On the Menu Bar, select *Communication* → *Store* (or click the *Store Settings* icon ) , then OK to store parameters to the drive nonvolatile memory.

3b Configuration (Position Mode)

Integrate QuickStart into your System



Command Source Selection

1. In the Block Diagram window, select the *Command Source* block.



2. Select the appropriate command source
 - a. Step and Direction
 - b. Encoder Following
3. Clicking the ellipsis button, ..., accesses additional parameters such as step and direction and encoder following scaling and parameters for *Load Target*
4. Click *OK* on the Command Source window.

Note: *No Command* is designed to be a non-operation input source. If the drive is in velocity or current mode, *No Command* will always provide a command of zero. If the drive is in position mode, when the command is set to *No Command* the drive sets *Position Target* equal to the *Position Measured* to prevent sudden motion.

Further assistance is available through any of the following:

- DriveSuite Help files
- www.a-m-c.com
- Technical Assistance via phone: 805-389-1935
- Technical Assistance via e-mail: techsupport@a-m-c.com.

Going into Production

Prototype to Production

Once you have completed your proof of concept you will be ready to design for production. If you decide that the QuickStart drive and motor are perfect for you then you're in luck. Both are popular off-the-shelf items that are readily available. Drives can be ordered directly from us and we can put you in touch with the appropriate motor supplier.

If your servo system requires a drive that better fits your application such as:

- Additional features
- Different power range
- Smaller size
- Different form factor such as 'plug in' style drives
- Network connectivity

Then our applications engineers can help optimize your system by selecting the best drive for your needs.

You will also be in contact with a local representative to help you with the selection of motors and other system components such as cables, gear boxes, slides, bearings and more.

Feedback

Your feedback is important to us. Your comments can make QuickStart better and help us improve our processes, technical support, customer support and product offering. Please go to www.a-m-c.com/feedback.html

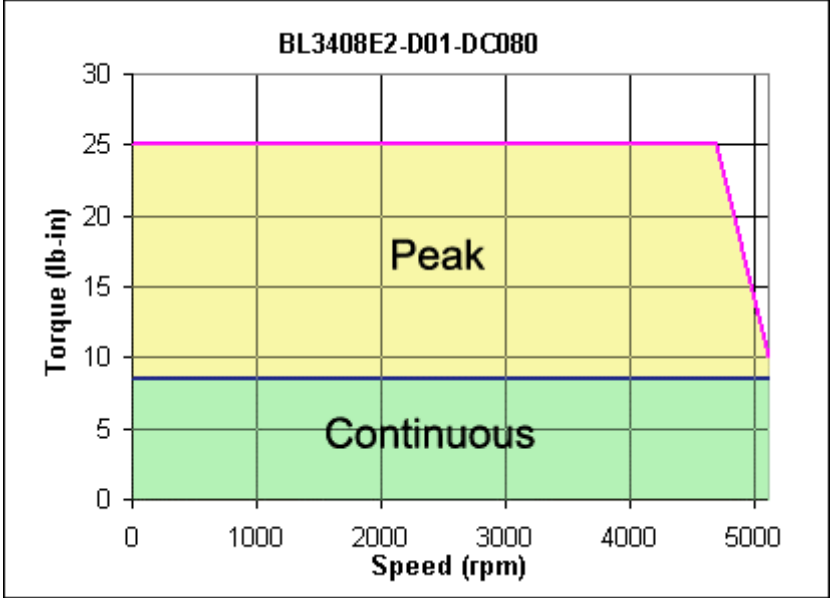
5

Appendix Appendix



- A. System Specifications**
- B. Drive**
- C. Motor**
- D. Cables**
- E. System Interface Board**

System Specifications

Torque – peak	25 lb-in, 2.82 Nm
Torque – continuous	8.44 lb-in, 0.95 Nm
Velocity Maximum	5100
Supply Voltage	20-80VDC
Encoder Resolution	10000 counts / rev
Speed Torque Curve	 <p>The graph illustrates the speed-torque characteristics of the BL3408E2-D01-DC080 motor. The y-axis represents Torque in lb-in, ranging from 0 to 30. The x-axis represents Speed in rpm, ranging from 0 to 5000. The 'Peak' region (yellow) shows a constant torque of 25 lb-in from 0 to 4500 rpm, followed by a linear decrease to 10 lb-in at 5000 rpm. The 'Continuous' region (green) shows a constant torque of 8.44 lb-in from 0 to 5000 rpm.</p>

DIGIFLEX® DIGITAL SERVO DRIVES MODEL: DR100EE20A8BDC

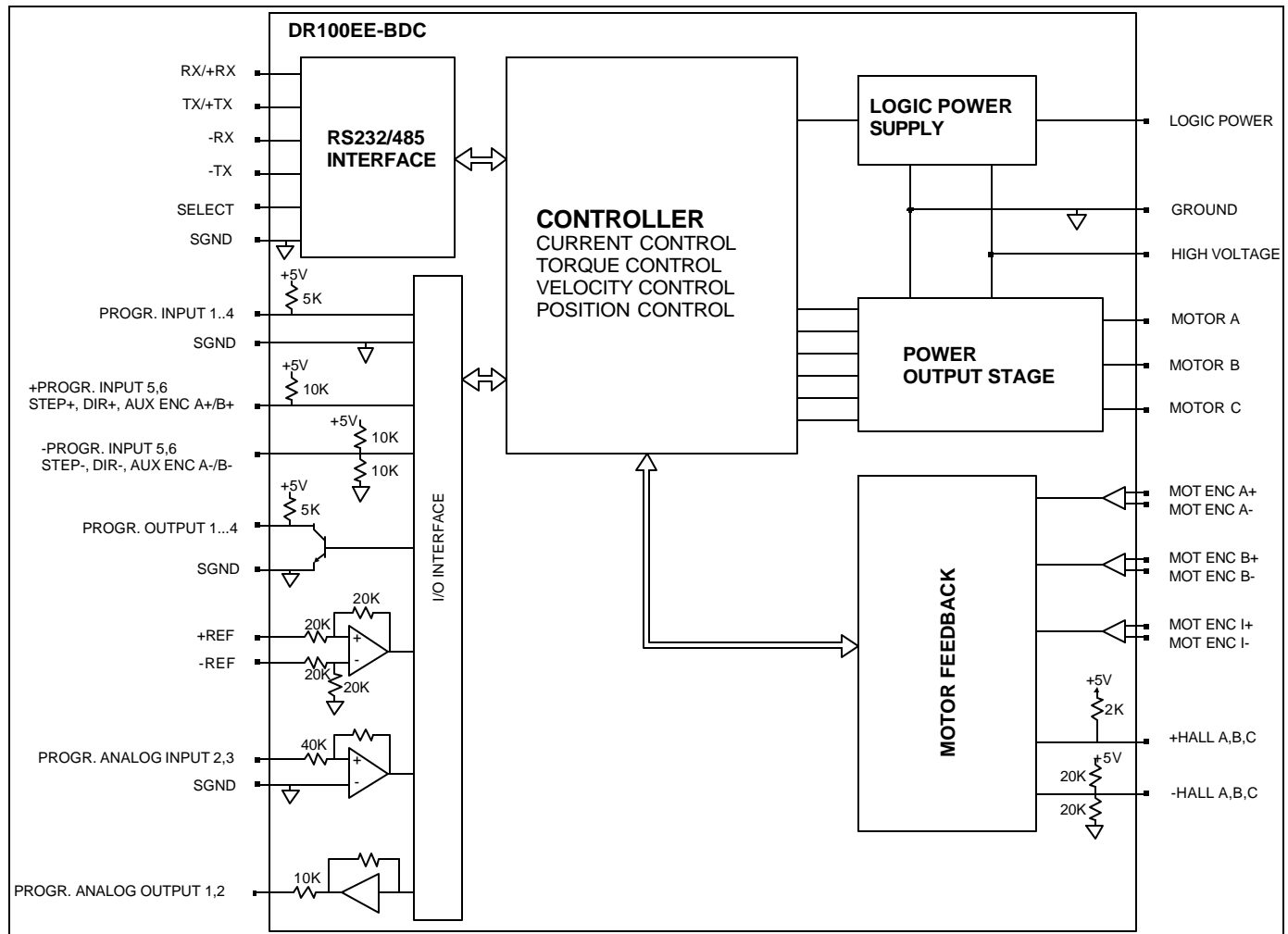
FEATURES:

- Fully digital, state-of-the-art design
 - Space Vector Modulation and vector control technology
 - 20kHz Digital current loop with programmable gain settings
 - PIDF velocity loop with 100microsecond update rate
 - PID + FF position loop with 100 microsecond update rate
 - Hall sensor + encoder or encoder-only based commutation
 - Surface-mount technology
 - Small size, low cost, ease of use
-
- RS232/485 interface for setup and networking
 - Windows© based setup software with built-in 8-channel digital scope
 - Operates in torque, velocity or position mode with programmable gain settings
 - Programmable profiling in all modes
 - Fully configurable current, voltage, velocity and position limits.
 - Step & direction mode for stepper replacement
 - Encoder following with programmable gear ratio
-
- 4 programmable digital inputs
 - 2 programmable differential inputs, configurable as step & direction, master encoder, or secondary encoder for dual loop operation
 - 4 programmable digital outputs
 - 2 programmable analog inputs (10-bit)
 - 14-bit reference input or programmable analog input
 - 2 programmable analog outputs (10-bit)
 - Encoder output (from motor, optionally buffered)
-
- Four quadrant regenerative operation
 - Separate backup logic supply input
 - Bi-color LED status indicator
 - Extensive built-in protection against:
 - over-voltage (programmable)
 - under-voltage (programmable)
 - short-circuit: phase-phase, phase-ground
 - over-current
 - over-temperature



ADVANCED MOTION CONTROLS

3805 Calle Tecate, Camarillo, CA 93012
Tel: (805) 389-1935, Fax: (805) 389-1165

BLOCK DIAGRAM:**DESCRIPTION:**

The DR100EE Series digital PWM servo drives are designed to drive brushed and brushless servomotors. These fully digital drives operate in torque, velocity, or position mode and employ Space Vector Modulation (SVM), which results in higher bus voltage utilization and reduced heat dissipation. The command source can be generated internally or can be supplied externally. In addition to motor control, these drives feature dedicated and programmable digital and analog inputs and outputs to enhance interfacing with external controllers and devices.

DR100EE Series drives feature a single RS232/485 interface, which is used for drive configuration and setup as well as online operation in networked applications. Drive commissioning can be accomplished through a fully graphical Windows® based application.

All drive and motor parameters are stored in non-volatile memory.

SPECIFICATIONS:

POWER STAGE SPECIFICATIONS	DR100EE20A8BDC
DC SUPPLY VOLTAGE	20...80 VDC
PEAK CURRENT	20A (14.2Arms)
MAXIMUM CONTINUOUS CURRENT	10A (7.1Arms)
MINIMUM LOAD INDUCTANCE	250 μ H
SWITCHING FREQUENCY	20 kHz
HEATSINK (BASEPLATE) TEMPERATURE RANGE	0 to 65 °C, disables at 65 °C
POWER DISSIPATION AT CONTINUOUS CURRENT	50W
MIN. UNDER VOLTAGE SHUTDOWN	20 VDC
MAX. OVER-VOLTAGE SHUTDOWN	86 VDC
LOGIC SUPPLY VOLTAGE (backup supply)	20...80 VDC, 20W maximum

MECHANICAL SPECIFICATIONS	
POWER CONNECTOR: P1	Plug-in with crimp-terminal
MOTOR FEEDBACK CONNECTOR: CN3*	15-pin high density female D-sub
I/O CONNECTOR: CN2*	26-pin high density female D-sub
COMMUNICATIONS INTERFACE (RS232/485): CN1*	9-pin female D-sub
SIZE	5.22 x 3.52 x 1.42 inches 132.5 x 89.5 x 35.9 mm
WEIGHT	1 lb. 0.44 kg

* Mating connectors are not included.

PIN FUNCTIONS:

P1 - Motor and Power Connector:

CAUTION: the pin numbering of the mating connector is different from the numbering of the drive connector. In the table below, the second column corresponds to the drive pin numbering (silkscreen). The second to last column corresponds to the mating connector pin numbering.

DRIVE CONN.	PIN	NAME	DESCRIPTION	I/O	PIN	MATING CONN.
P1	1	MA	Motor phase A	O	6	
	2	MB	Motor phase B	O	5	
	3	MC	Motor phase C	O	4	
	4	HV IN	DC motor and power input. This input is used to supply power to the motor and drive logic circuitry.	I	3	
	5	GND	Ground	GND	2	
	6	LOGIC PWR	Logic supply input. This input can be used to supply power to the drive logic circuitry only. Effective only when the voltage applied to pin P1-4 is lower then the voltage applied to P1-6.	I	1	

CN3 - Motor Feedback Connector:

CONNECTOR	PIN	NAME	DESCRIPTION	I/O
CN3	1	+Hall A	Commutation sensor inputs. Internal 2K pull-up to +5VDC. Can be used with single ended or differential Hall sensors.	I
	2	+Hall B		I
	3	+Hall C		I
	4	MOT ENC A+	Differential Encoder Input. For single ended encoder signals, leave the A-terminal open.	I
	5	MOT ENC A-		I
	6	MOT ENC B+	Differential Encoder Input. For single ended encoder signals, leave the B-terminal open.	I
	7	MOT ENC B-		I
	8	MOT ENC I+	Differential Encoder Input. For single ended encoder signals, leave the I-terminal open.	I
	9	MOT ENC I-		I
	10	-Hall A*	See CN3-1. Leave open in case of single ended Hall sensors.	I
	11	-Hall B*	See CN3-2. Leave open in case of single ended Hall sensors.	I
	12	SGND	Signal ground	SGND
	13	+5V OUT	+5V @ 250mA max. Short-circuit protected.	O
	14	PAI3	Programmable analog input, single ended, 10-bit	I
	15	-Hall C*	See CN3-3. Leave open in case of single ended Hall sensors.	I

* Contact factory for SE compatible options.

CN2 – I/O Connector:

CONNECTOR	PIN	NAME	DESCRIPTION	I/O
CN2	1	PDO1*	Programmable digital output	O
	2	SGND	Signal ground	SGND
	3	PDO2*	Programmable digital output	O
	4	+REF	Differential reference signal input, 14-bit resolution. Can also be used as programmable analog input 1.	I
	5	-REF		I
	6	PAI2	Programmable analog input	I
	7	PAO1	Programmable analog output	O
	8	PAO2	Programmable analog output	O
	9	-PDI6	Programmable Input (see CN2-18) or Direction- or Aux Enc B-	I
	10	PDO3	Programmable digital output	O
	11	PDI1	Programmable digital input	I
	12	PDI2	Programmable digital input	I
	13	PDI3	Programmable digital input	I
	14	PDO4	Programmable digital output	O
	15	+5V OUT	+5VDC. Note: the total current on CN2-15 and CN3-13 combined should not exceed 250 mA	O
	16	SGND	Signal ground	SGND
	17	+PDI5	Programmable differential digital input, or Step+ or Aux Enc A+	I
	18	+PDI6	Programmable, differential digital input or Direction+ or Aux Enc B+	I
	19	PDI4	Programmable digital input	I
	20	Encoder Channel A+	Encoder Output (from connector CN3), not buffered	O
	21	Encoder Channel A-		O
	22	Encoder Channel B+	Encoder Output (from connector CN3), not buffered	O
	23	Encoder Channel B-		O
	24	Encoder Channel I+	Encoder Output (from connector CN3), not buffered	O
	25	Encoder Channel I-		O
	26	-PDI5	Programmable Input (See CN2-17) or Step- or Aux Enc A-	I

* Contact factory for SE compatible options.

CN1 - Communications Interface (RS232/485):

CONNECTOR	PIN	NAME	DESCRIPTION	I/O
CN1	1	SELECT	RS232/485 selection. Pull to ground (CN1-5) for RS485.	I
	2	TX/+TX	RS232: Transmit; RS485: +TX	O
	3	RX/+RX	RS232: Receive; RS485: +RX	I

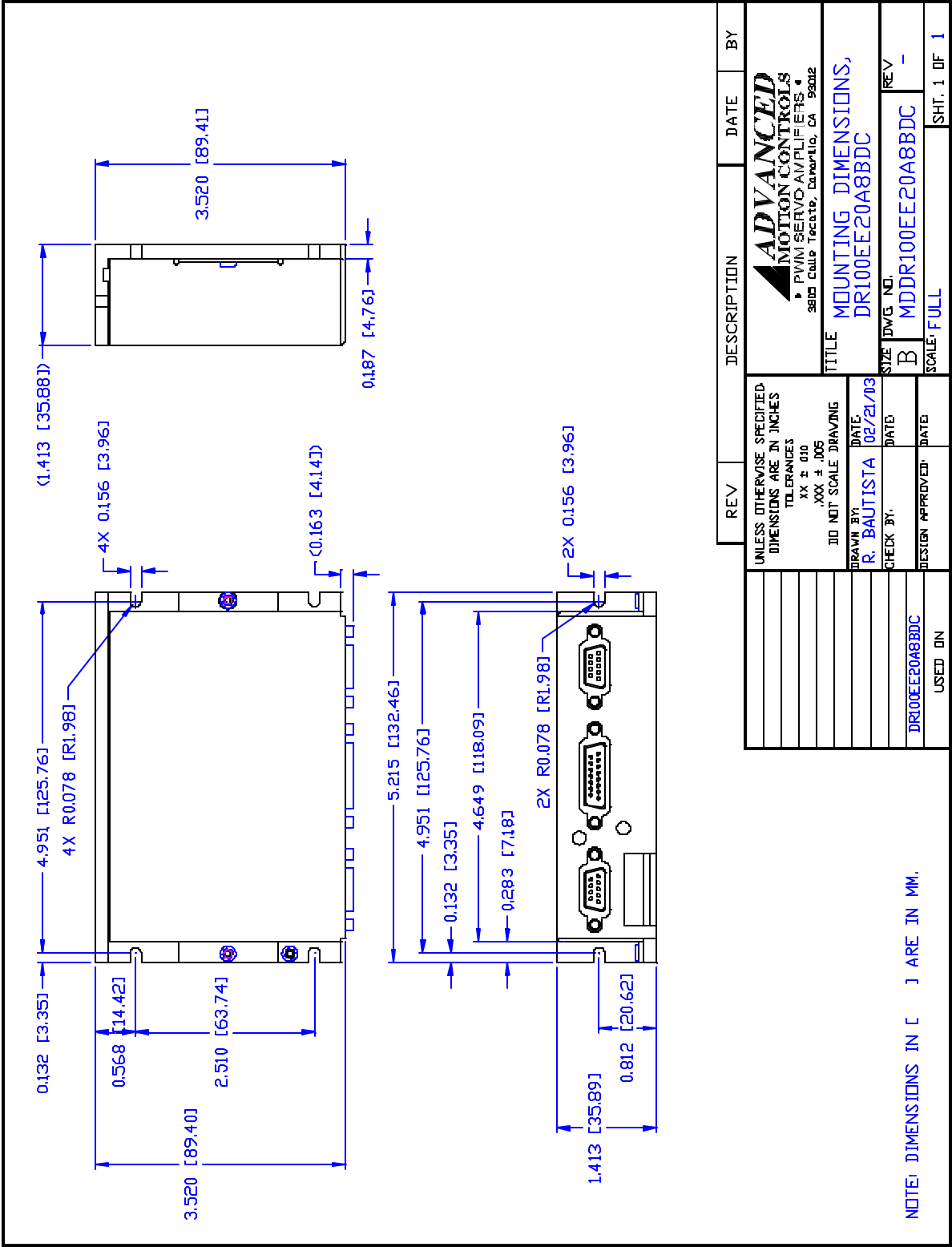
	4	N/C	Not connected	
	5	SGND	Signal ground	SGND
	6	-TX	RS485: -TX	O
	7	N/C	Not connected	
	8	-RX	RS485: -RX	I
	9	N/C	Not connected	

ORDERING INFORMATION:

Standard model: DR100EE20A8BDCX

X indicates the current revision letter.

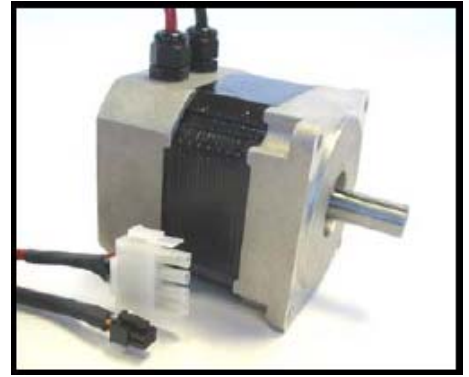
MOUNTING DIMENSIONS:



MBL3408E2 BRUSHLESS SERVO MOTOR

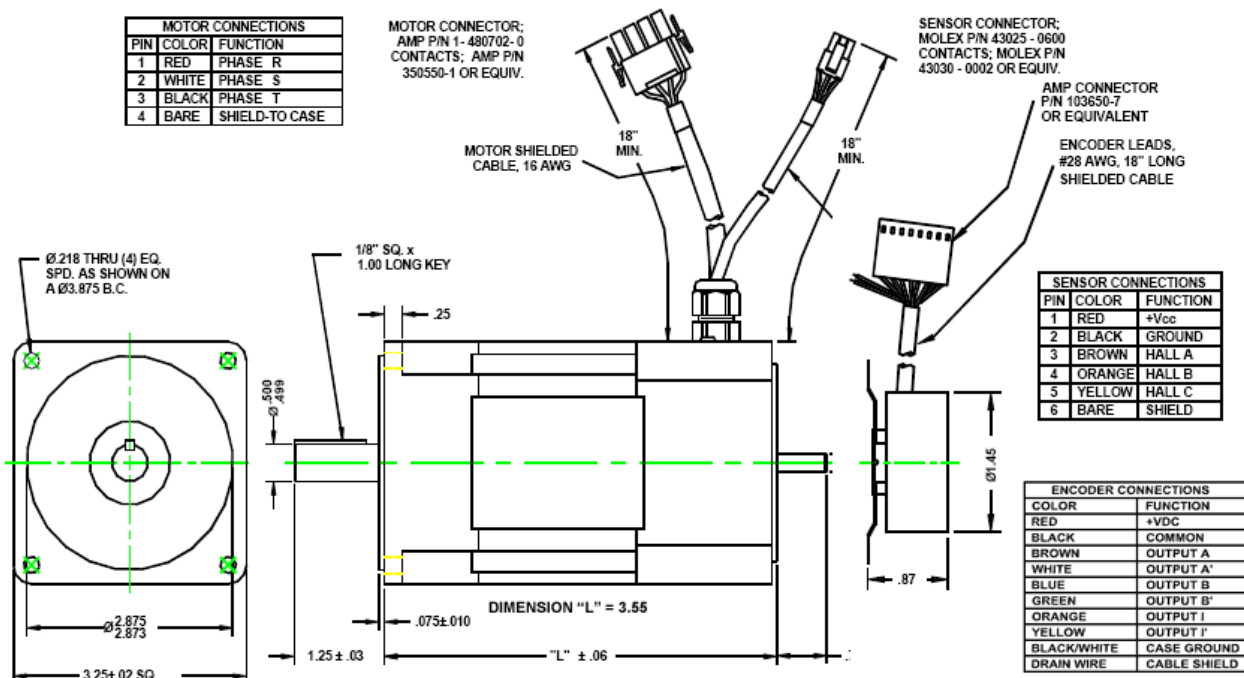
FEATURES:

- 3.25 Inch NEMA 34 w/ Heavy Duty Shaft
- Continuous Torques up to 8.44 lb-in
- Speeds up to 6000 rpm
- Voltage Rating up to 170 Vdc
- Integrated Hall Effect Commutation
- 30 Lb Radial Load Capacity, 1/2" from Front Face
- High Precision Optical Encoders – 10000 count



SPECIFICATIONS:

SPECIFICATIONS	UNITS	VALUE
CONTINUOUS TORQUE	Nm (lb-in)	0.95 (8.44)
PEAK TORQUE	Nm (lb-in)	2.82 (25)
SPEED @ RATED VOLTAGE	RPM	6000
RATED VOLTAGE	V dc	170
CONTINUOUS CURRENT	A	7.2
PEAK CURRENT	A	21.4
TORQUE CONSTANT	Nm / A (lb-in / A)	0.143 (1.27)
VOLTAGE CONSTANT	V / KRPM	15
RESISTANCE	ohms	0.443
INDUCTNACE	mH	1.89
INERTIA	kg-cm ² (lb-in-s ²)	1.017 (0.0009)
WEIGHT	Kg (lb)	2 (4.4)

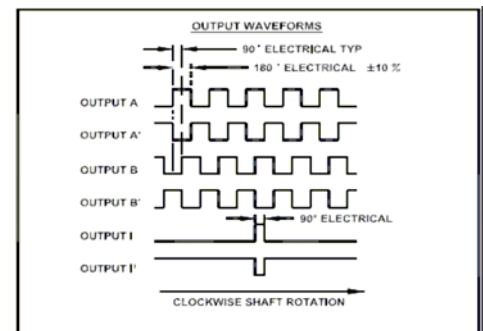
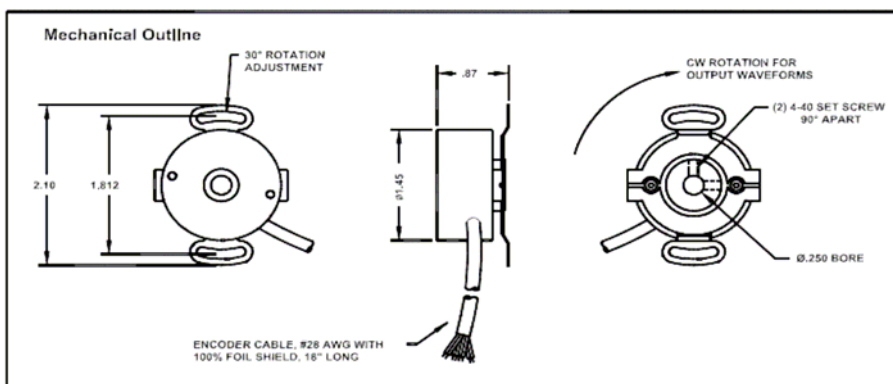


ENCODER:

ELECTRICAL SPECIFICATIONS	VALUE
INPUT VOLTAGE	5 VDC +/- 5%
INPUT CURRENT REQUIREMENTS	125 mA Typical @ 5 VDC Plus Interface Loads
INPUT RIPPLE	2% Peak to Peak @ 5 VDC
OUTPUT CIRCUITS	AM26LS31 RS 422A Line Driver
FREQUENCY RESPONSE	500 kHz
INCREMENTAL OUTPUT FORMAT	Quadrature with A leading B for CW rotation. Index Pulse centered over A.
SYMMETRY	180 Degrees +/- 10% Typical
MINIMUM EDGE SEPARATION	54 electrical degrees
COMMUTATION FORMAT	N/A
COMMUTATION ACCURACY	N/A

ENVIRONMENTAL SPECIFICATIONS	VALUE
STORAGE TEMPERATURE	-40 to 125° C
OPERATING TEMPERATURE	-20 to 100° C Typical
HUMIDITY	98% Non-Condensing
VIBRATION	20 G's @ 50 to 500 CPS
SHOCK	50 G's @ 11 ms duration

MECHANICAL SPECIFICATIONS	VALUE
LINE COUNT	2500 lines/revolution
MAXIMUM SHAFT SPEED	8000 RPM
THROUGH SHAFT DIAMETER	0.250" (-0.0000", +0.0005")
RADIAL SHAFT MOVEMENT	0.007" TIR
AXIAL SHAFT MOVEMENT	+/- 0.030" MAX
HOUSING	Carbon Fiber Composite (case ground via cable)
TERMINATION	15 conductor cable, 28 AWG, 18" long
MOUNTING	1.812" Bolt Circle
MOMENT OF INERTIAL	1.5×10^{-4} oz-in-s ²
ACCELERATION	1×10^5 Radians/s ²
ACCURACY	+/- 1.0 Arc Minutes



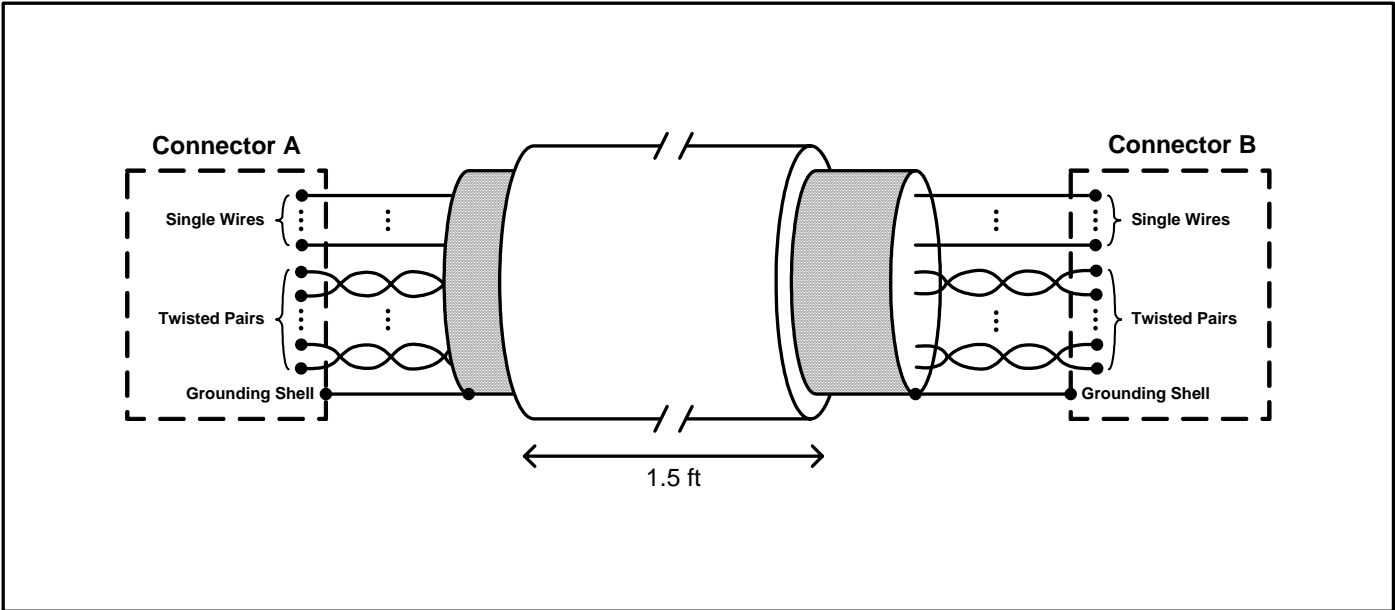
CBL-D03 DRIVE CABLE

WIRING SPECIFICATIONS:

CABLE: CBL-D03						
Side 1 (Drive)		Common			Side 2 (SIB)	
Connector	Contact	Wiring Scheme	Function	Wire Color	Contact	Connector
A 26-Pin AMP (D-SUB) Plug: P/N 748365-1 Housing: P/N 748677-2 Terminals: P/N 748333-4	1	Single Wire	PDO1	red/black	1	B 26-Pin AMP (D-SUB) Plug: P/N 748365-1 Housing: P/N 748677-2 Terminals: P/N 748333-4
	2	Single Wire	SGND	pink	2	
	3	Single Wire	PDO2	blue	3	
	6	Single Wire	PAI2	blue/white	6	
	7	Single Wire	PAO1	black	7	
	8	Single Wire	PAO2	black/white	8	
	10	Single Wire	PDO3	orange	10	
	11	Single Wire	PDI1	orange/white	11	
	12	Single Wire	PDI2	orange/black	12	
	13	Single Wire	PDI3	white	13	
	14	Single Wire	PDO4	yellow	14	
	19	Single Wire	PDI4	yellow/black	19	
	4	Twisted Pair	+REF	green	4	
	5		-REF	green/white	5	
	9	Twisted Pair	-PDI6	purple	9	
	18		+PDI6	purple/white	18	
	15	Twisted Pair	5V	red	15	
	16		SGND	red/white	16	
	17	Twisted Pair	+PDI5	gray	17	
	26		-PDI5	gray/black	26	
	20	Twisted Pair	Encoder A+	brown	20	
	21		Encoder A-	brown/white	21	
	22	Twisted Pair	Encoder B+	pink/red	22	
	23		Encoder B-	pink/black	23	
	24	Twisted Pair	Encoder I+	green/black	24	
	25		Encoder I-	light green	25	
	Shell	Shield	Shield	-	Shell	

NOTE: For cables with only twisted pairs, single wires can be paired with other single or unused wires.

DIAGRAM:



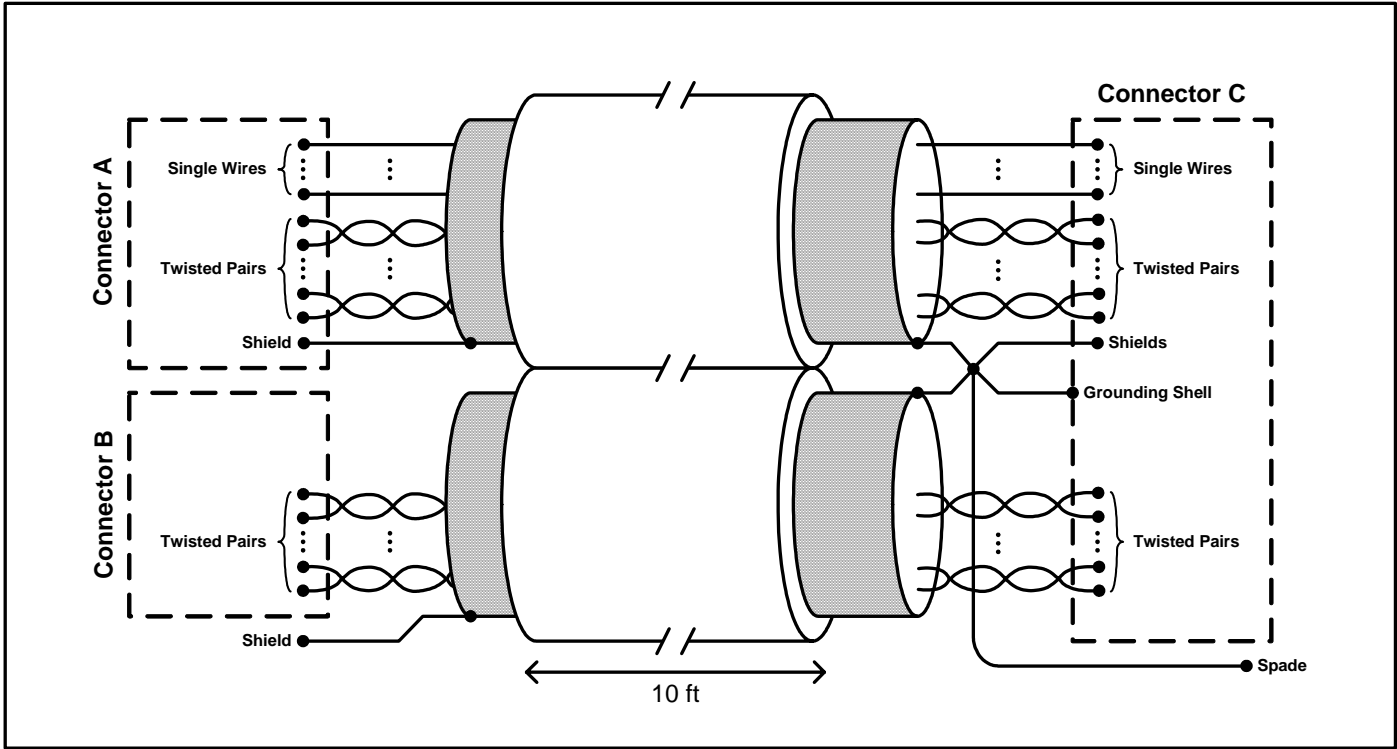
CBL-F02-10 FEEDBACK CABLE

WIRING SPECIFICATIONS:

CABLE: CBL-F02-10						
Side 1		Common			Side 2	
Connector	Contact	Wiring Scheme	Function	Wire Color	Contact	Connector
A 6-Pin Molex Connector: P/N 43020-0601 Terminals: P/N 43031-0002	3	Single Wire	Hall A	Brown	1	C 15-Pin AMP (D-SUB) Plug: P/N 748364-1 Housing: P/N 748677-1 Terminals: P/N 748333-4
	4	Single Wire	Hall B	Orange	2	
	5	Single Wire	Hall C	Yellow	3	
	1	Twisted Pair	5V	Red	13	
	2		SGND	Black	12*	
	6	Shield	Shield	White/Black	Shell*	
B 8-Pin Molex Connector: P/N 70107-0007 Terminals: P/N 16-02-0077	3	Twisted Pair	A+	Brown	4	
	4		A-	White	5	
	5	Twisted Pair	B+	Blue	6	
	6		B-	Green	7	
	7	Twisted Pair	I+	Orange	8	
	8		I-	Yellow	9	
	1	Twisted Pair	5V	Red	13	
	2		SGND	Black	12*	
	Flying Lead	Shield	Shield	-	Shell*	
	-	-	-	-	Shell*	
	-	-	-	-	-	
	-	-	-	-	-	

* Indicates contacts that share continuity with the connector shell (see diagram).

DIAGRAM:

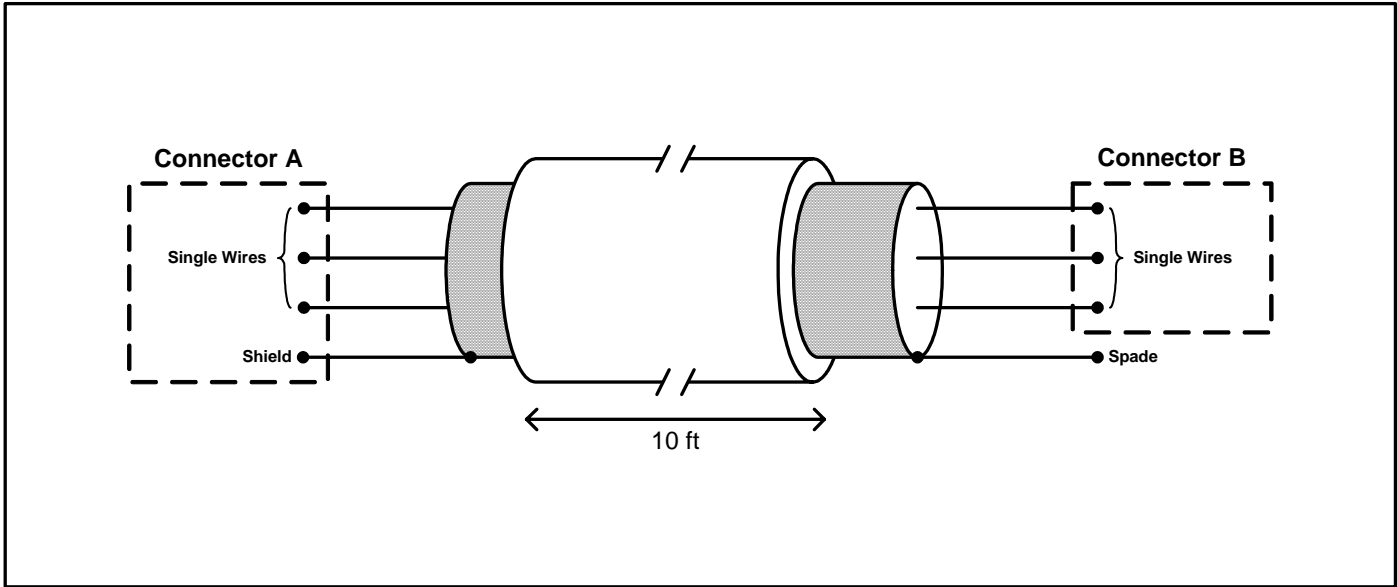


CBL-P04-10 POWER CABLE

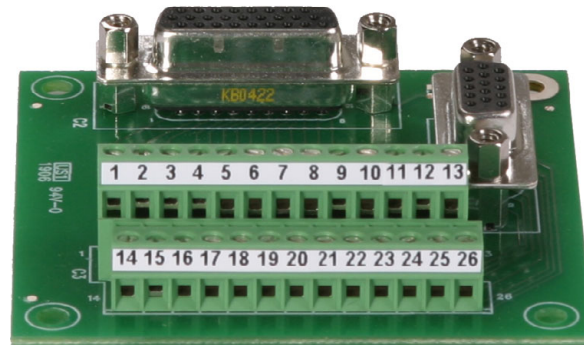
WIRING SPECIFICATIONS:

CABLE: CBL-P04-10						
Side 1		Common			Side 2	
Connector	Contact	Wiring Scheme	Function	Wire Color	Contact	Connector
A (4-Pin AMP) Connector, Terminals: P/N 1-480703-0, P/N 350873-1	1	Single Wire	Motor A	red	1	B (3-Port Phoenix) Connector: P/N 1805990
	2	Single Wire	Motor B	white	2	
	3	Single Wire	Motor C	black	3	
	4	Shield	Shield	grey	Spade	

DIAGRAM:



System Interface Board (SIB)



Dimensions	72mm x 72mm
C1 Connector	15 pin to motor
C2 Connector	26 pin to drive
C3 Connector	26 pin user interface.

C3 Pin Functions

Pin	Function
1	PDO1
2	SGND
3	PDO2
4	+REF
5	-REF
6	PAI2
7	PAO1
8	PAO2
9	-PDI6
10	PDO3
11	PDI1
12	PDI2
13	PDI3
14	PDO4
15	+5V OUT
16	SGND
17	+PDI5
18	+PDI6
19	PDI4
20	Encoder Channel A+
21	Encoder Channel A-
22	Encoder Channel B+
23	Encoder Channel B-
24	Encoder Channel I+
25	Encoder Channel I-
26	PDI5

